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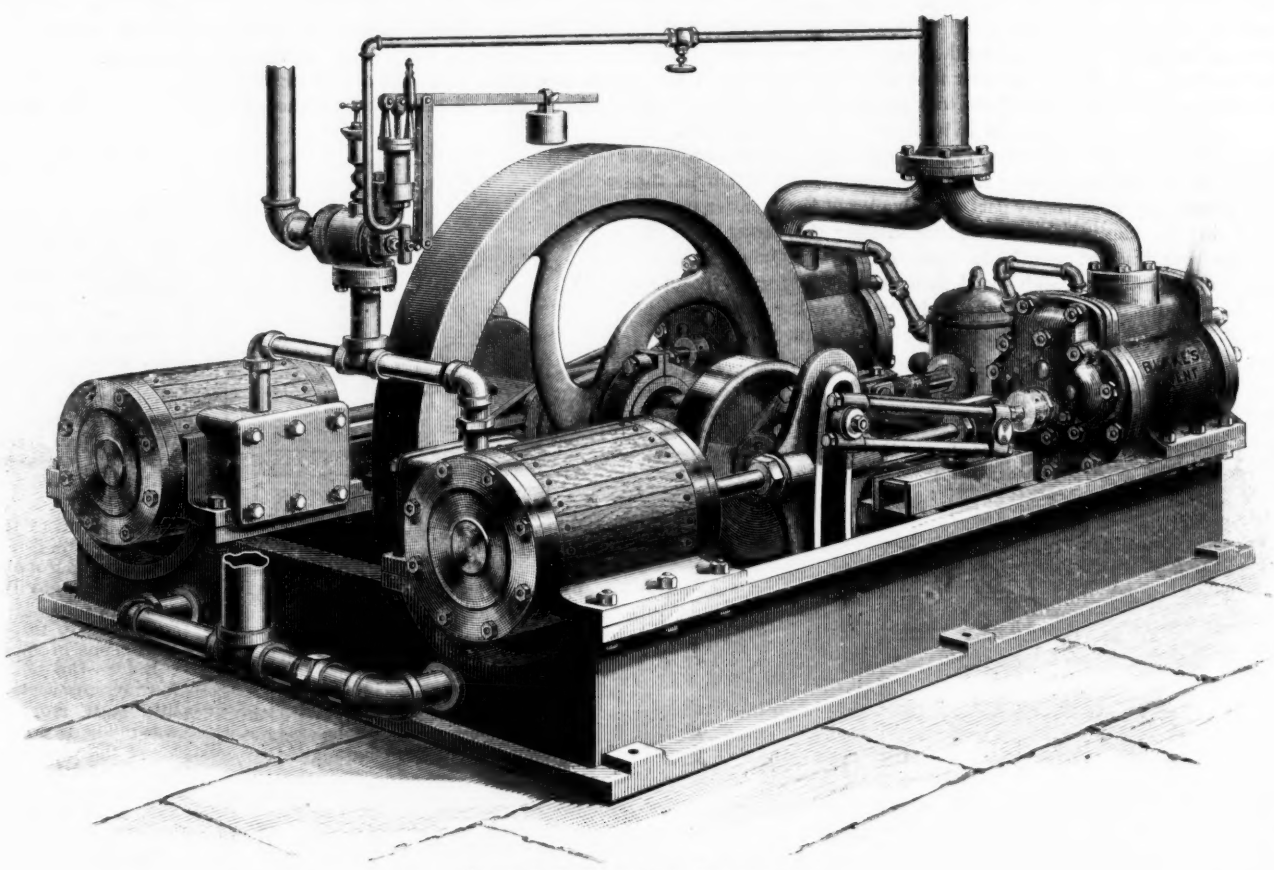
Blake's New Duplex Air Compressor.

The engraving upon this page is that of a new duplex air compressor, built by the George F. Blake Manufacturing Company, New York and Boston. The style here shown has steam cylinders 10″ in diameter and air cylinders of the same diameter, with 12″ stroke. The bedplate is made of a single casting, without joints of any kind. Both the steam and air cylinders are securely bolted to the bedplate in the manner shown, so that they may be removed and replaced with the least possible difficulty. The chief characteristic of this compressor is the connection between the crosshead and crank. By means of this connection the compressor is "compressed" into less space than could otherwise be well secured. The piston-rod of the steam cylinder is connected with the piston-rod of the air cylinder by a cast-iron yoke. This device, while occupying the same space as the Scotch yoke, is free from its serious objections, (one of which is an excessive friction) inasmuch as the crank-pin boxes instead of sliding up and down in the yoke do not touch it at all. They are attached to one end of a connecting rod, while the other end of this rod is connected with the crosshead, as shown.



BLAKE'S DUPLEX AIR COMPRESSOR.

These connecting rods are made of two round steel rods, which pass through the boxes and are adjusted by nuts outside, as represented. This design makes a very light and easily managed rod. The reader will observe, then, that this compressor has all the advantages of those made with regular connecting rods, yet the cylinders are brought very near together. The crank-pin travels up and down in the opening through the yoke, having plenty of clearance at the top, bottom, and sides. There are two connecting rods for each crank-pin, being connected with the crank-pin at either side of the yoke. With an arrangement of this kind the lost motion is more readily taken up than with the old-fashioned Scotch yoke; besides, the difficulties of frequent adjusting and renewing of the slides and boxes are overcome. The cranks are of the disc form, and are balanced.

The air cylinders are kept cool by water rapidly circulated through the water jackets. This is accomplished by a special, double-acting water pump, worked by an eccentric upon the main shaft. This pump is located between the air cylinders and draws its water from a tube or tank supplied from a hydrant, or by any other convenient method. The rapidity with which the water circulates through the water jackets is controlled by the speed of the compressor. As the speed increases the circulation of water is correspondingly hastened, and when the speed is reduced the circulation of water is also retarded, and when the compressor stops there is no waste of water.

When the compressor is in operation there is an ample supply of water at all times to keep the air cylinders cool. When water is supplied to the water jackets from a head, or from an independent pump, there is always more or less waste.

The compressor here shown is intended for use for driving rock drills and other similar purposes. The speed is controlled by a governor valve upon the steam pipe, having a pipe connection with the air pipe of the compressor. This governor works somewhat on the principle of a safety valve, only there is no escape from it of either steam or air. The air pressure rising in the pipes of the compressor presses upon the governor piston.

This piston, in rising, partly or completely closes the throttle, motion being communicated to it through a link connection with the weighted lever shown. By adjusting this weight out or in, the limited constant pressure in the reservoir or air pipes may be correspondingly increased or diminished, and may be maintained at any desired pressure within the capacity of the compressor.

This automatic governing attachment relieves the engineer of a great responsibility in watching the pressure. Variations of steam pressure do not affect the working of this compressor, as it regulates itself, starting as the air pressure falls, and stopping as it rises.

The uses and various adaptations of air compressors having been greatly extended during the past few years, extensive and valuable improvements are constantly being made in this class of machinery. The one here shown is the latest production of the company previously mentioned. It is made in several different sizes, to suit the various branches of engineering requiring the use of air compressors.

Two inventors in Bohemia are said to have patented a process for enamelling cast-iron water pipes, which can be applied to other hollow castings that are made with cores. It consists in simply covering the sand core with enamel, and then pouring in the iron as usual. The heat of the melted iron fuses the enamel, which attaches itself firmly to the iron, and detaches itself so completely from the sand that the enamel is said to be all that can be desired for water pipes and other industrial purposes. In casting sinks, basins, urinals, etc., the enamel can be applied to the sand on that side of the mould which is to form the inside of the basin. The composition of the new enamel is kept a secret, but is said to differ from the old form in the simplicity of its preparation and the extraordinary cheapness of the materials used. In color this new enamel is gray.

The French Academy of Sciences is investigating the operation of a new wire for electric lighting, the point gained in the use of this wire being the prevention of accidents from fire, brought about by contact of the wire with inflammable substances. It consists of a copper wire covered with asbestos, the whole being inclosed in a lead pipe. From experiments, it is said the copper wire may be entirely destroyed by heat without in any way disturbing the lead pipe.

The construction of the new Michigan, Indiana and St. Louis Railroad will shortly be commenced. It will be 166 miles in length, and will run from Sturgis, Mich., to Danville, Ill., where it will connect with the Danville and East St. Louis Railroad to St. Louis.

Gas company officials are improving in politeness and general disposition to please customers since the electric light has been coming into extensive use. They are receiving about as many orders from customers as ever, but some of them run as follows: "Send around a man and take out my gas meter."

The Fort Worth and Denver City Railroad is now completed to Wichita Falls, a distance of 110 miles, and will be in operation to that point in a few days. Wichita Falls has probably the finest water power in Texas, and is situated in one of the most fertile valleys of the State, into which a large population is moving. It will be the great cattle shipping point for the Panhandle region, and will be the depot of a large traffic with the northwestern counties and the Indian Territory. At the beginning of the year the inhabitants of the town numbered less than 100; at present they are over 1,000.

The third annual meeting of the United States Association of Charcoal Iron Workers will be held in Chattanooga, Tenn., on October 18th.

The Upper Mississippi is becoming filled with sawdust, to the great detriment of navigation. The sawdust sinks to the bottom of the river, and becomes one of the hardest of substances to remove.

Light nickel plating, it is said, may be done by heating a bath of pure granulated tin, argol (crude tartar) and water, to boiling, and adding a small quantity of red-hot nickel oxide. A brass or copper article immersed in this solution is instantly covered with nearly pure nickel. By adding a little cobalt carbonate, or cobalt tartrate, a bluish tint is produced, varying in intensity with the quantity of cobalt used. While this process may not be of advantage in the instance of large quantities of plating, if found to work satisfactorily it could be advantageously employed in a small way, as for the occasional plating of small articles.

Clearance and Compression.

BY E. A. MARSH.

As Professor Sweet has raised the question, "Are not some of us getting our clearance and others getting rid of it at a fearful sacrifice," I will try to answer the conundrum by setting forth some of the "points" which this question involves. I am led to look upon clearance as a three-fold evil. First, as a waste space, for which, when excessive, I can frame no reasonable excuse. Second, because it entails upon the engine the labor of compression; and, third, because it increases the condensing surface in the cylinder. I do not know to what extent condensation is affected there, by metallic contact, but assuming that it is considerable, we may here score a good point against clearance. Compression, I believe, is intended to serve a two-fold purpose; first, to overcome a fault in the design of the engine, which means that if the clearance space is not filled with steam by compression, the live steam which would fill it would be nearly a total loss; second, to form an elastic cushion which will receive and give back the otherwise wasted energies which the reciprocating parts have acquired by momentum. It has always been a mystery to me (and I wish some one would rise and explain it) why any degree of compression will prevent an engine from pounding when there is lost motion in its bearings, or make an engine pound when there is no lost motion.

Is it reasonable to suppose that a compression curve, commencing late in the stroke, would cause an engine to pound any more than a sudden admission in an engine where there is practically no compression? Perhaps thumping in engines of small clearance and high speed may be accounted for by the presence of water in the cylinder; for even if there were no water in the cylinder at the time when compression commences, the flattening of a small quantity of steam between two large surfaces much cooler than itself would cause rapid condensation, and the short time allowable would not be sufficient for the water to escape readily. In this case the abutment would be nearly metallic, even though the water be confined to some portion of the piston's disc.

The influence of the clearance space over the diagram and over the engine's performance is shown by the annexed cuts, Figs. 1 and 2.

I have chosen a card in which the clearance represents ten per cent. of the piston's displacement. The point of cut-off, *a*, is ⅘ of the piston's travel, or including the clearance, ½ the stroke. The expansion curve *a*, *i*, shows what the terminal would have been, uninfluenced by clearance, and the line *a*, *b*, shows what the steam in the clearance space adds to it by its expansion into the cylinder. For convenience we may consider the clearance space as a separate diagram, and a curve *c*, *d*, having the terminal *b*, and proportional cut-off *a*, would represent what the clearance gives out by expansion. The area, *c*, *f*, *d*, is the same as area *a*, *b*, *a*, *i*.

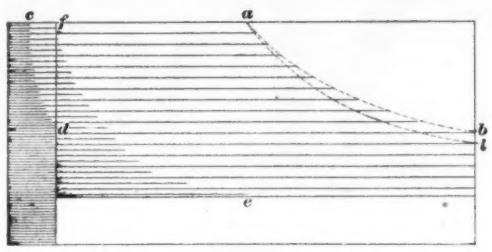


Fig. 1

This calculation may be more satisfactorily made, as in Fig. 2, wherein the line of average compression drawn through the clearance space represents this factor by the area *c'* and the remainder of this space represents what would be lost if there were no compression. But clearance has made compression necessary, and we will now see how much the necessity will cost. If the back pressure in first diagram is equal to or coincident with the atmospheric line, compression will have to begin as early in the stroke as point *e* and form the curve *e*, *f*, and, as shown by the line of average compression in Fig, 2, would form an area equal to the entire space allotted to clearance, and represent 14% of the engine's exertion.

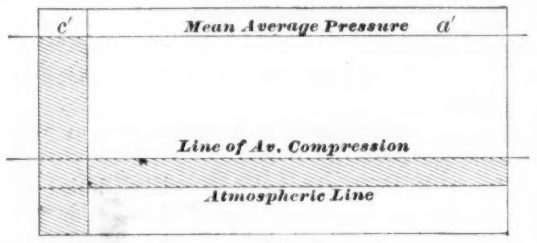
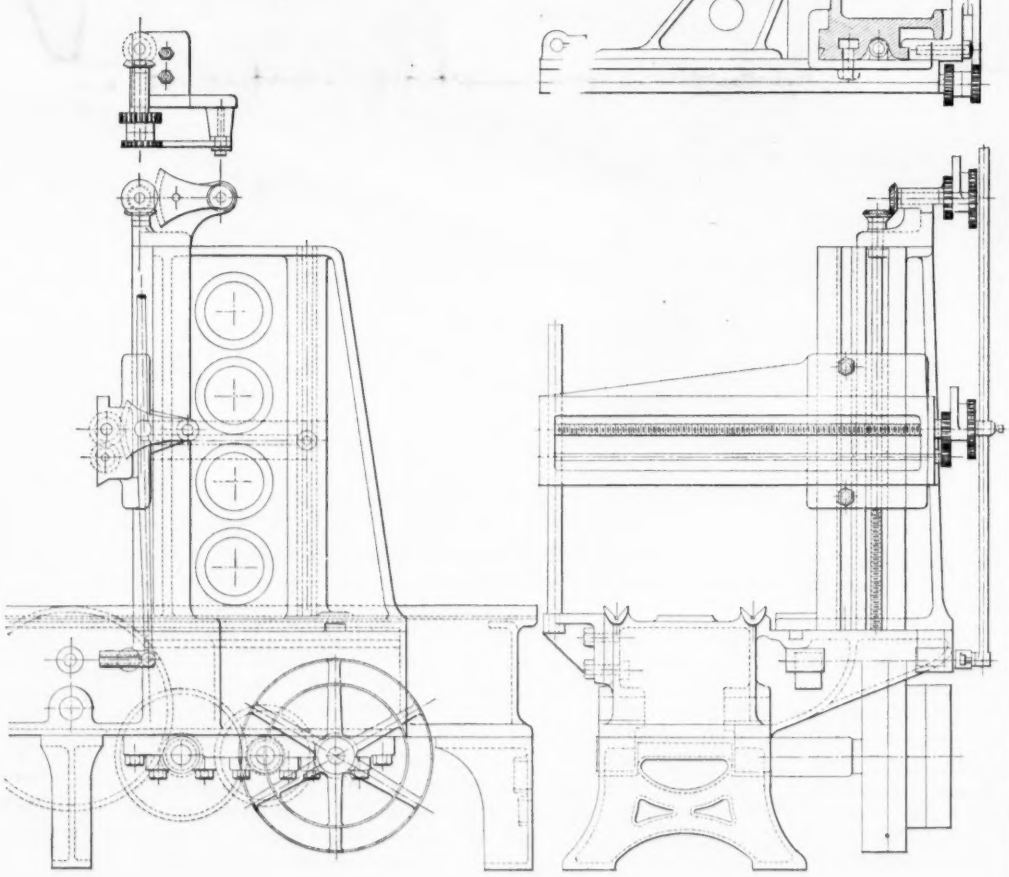


Fig. 2

Thus, under these conditions, the clearance has reduced the engine's capacity for work 14%. Although giving a higher terminal, it has reduced the *M. E. P.* 9%, and though it increased the terminal pressure, it also raised the theoretical water consumption per *I. H. P.* over 9%. To these figures also must be added an unknown loss, due to increased condensing surface. What its effect upon the crank-pin is, I shall not pretend to say; but the thought occurs to me now that not long ago certain high-speed men took metal out of their fly-wheels and put it into the reciprocating parts. It seemed to be a good plan, as it would absorb energy from the unexpanded steam in the early part and give it out in the latter part of the stroke, thus making the thrust upon the crank-pin more uniform. Query: Should high-speed men go back of former practice and make their reciprocating parts as light as a feather's weight, or must the office of heavy cross-head be neutralized by compression?



Detrick's New Single-Post Iron Planer.

From the numerous improvements recently made in iron planers, it would appear that little remains to be desired, yet the one shown in the engraving on page 5, as made by J. S. Detrick, Baltimore, Md., has several new and meritorious features, which render it of special value in performing certain classes of work. It is often found to be impracticable to plane pieces of work of greater width than will pass between the uprights of the ordinary planer, and it is equally difficult to plane work of great length. The planer here represented was designed not only to accomplish all that is required of an ordinary planer, but also to meet the objects just mentioned. It consists of a heavy bed and platen, resembling that of the ordinary planer, fitted up in a first-class manner. Motion is communicated to the platen through a train of cut gearing and a cut rack. The rack has a pitch of 1" and a face 4" wide. From the engraving, it will be seen that but one post or side piece is used. This post is unusually heavy, and of an L shape, to distribute the metal in a way to insure the greatest possible stiffness. This post is firmly secured to the bed in a manner that may be better understood by an inspection of the detail engravings on this page. The face of the post is of the same size and shape as the cross beam, so that when desired the cross beam may be removed, and the saddle carrying the tool-post may be removed from the cross beam and used upon the post. The saddle may be fed up and down in the same manner as it is fed upon the cross beam, by the feed mechanism as shown. This is a great advantage upon some kinds of large or special work.

The bearing of the cross beam upon the post is extra wide to insure large, durable wearing surfaces. These two are secured by a dovetail, an adjustable key, and three stout bolts, two in front and one at the back, as shown. In addition to these precautions, a triangular bracket is placed at the back of the cross beam, so as to bear upon a slide at the back of the post, as shown in the plan, thereby insuring extra stiffness. While using the planer upon regular work, as well as to afford extra support to the cross beam, one end of a movable connecting bar *C* is placed in a bracket *B*, bolted to the bed-plate, while the other end passes through a clamping socket upon the end of the cross beam. This is plainly shown in the engraving, page 3. When arranged with post in place, this planer will plane 24"×24" and 6' in length. Its weight is about 5,000 pounds. For all general work the cross beam is amply stiff without the connecting bar, but such a device is sometimes required to insure absolute stiffness for extra fine work. Provision is made for clamping a bracket to the bed, to which a pivot may be attached, as in planing the curves in links or segments of circles. This bracket may also be used to support the overhanging or outer ends of long pieces of work in planing This machine has adjustable feeds to suit all requirements, and may be easily changed without stopping the planer. The platen is driven by two belts upon pulleys of different diameters, to secure a quick return motion.

As will be seen from the detail engravings, these machines are also made with an up-and-down feed for the cross beam, as well as an up-and-down feed for the tool-post, which are not shown in the perspective view of the machine. All the flat surfaces are scraped.

The St. Gothard Tunnel.

EXTRACTS FROM A REPORT BY CONSUL BYERS, OF ZURICH.

The recent opening of the St. Gothard Railway through the Alps to Italy represents the completion of what is, perhaps, the most stupendous work of engineering known to the world.

* * * * *

The St. Gothard Pass is many centuries old, and is over a chain of mountains the highest in Europe, though not showing the highest single peaks. In the snow-fields, almost immediately above the new tunnel, rise the principal rivers of Switzerland flowing north and south—the Reuss, the Picino, the historic Rhone, and the classic Rhine.

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For centuries this mighty mass of mountains has stood as a barrier between the north of Europe and the sunny lands of Italy. The old Helvetians, under Orgetorix or Diviko, had not greater longings for an easy way to the warm southland than the Europeans of modern civilization have had.

Before the building of railroads it was a journey of weeks around the higher Alps into Italy from Switzerland. A foot-path was made over the St. Gothard from the valley of the Reuss as early as the beginning of the thirteenth century, but it remained a dangerous and dizzy foot-path only. It was only a hundred years ago that the first vehicle of any kind was dragged along this foot-path over the Alps.

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The idea of piercing the St. Gothard chain of mountains is as old as railroads in Switzerland. Engineers in Switzerland have lived and died with the one great thought of connecting the cold north with the sunny south by iron rails through the mountains.

The first railroad built in the country was opened in August of 1846. It was the line from Baden to Zurich, and the proposal was even then made to ask concessions to enable the company to continue its lines into the mountains of the Grisons and over one of the high passes. The rivalry of other companies, the jealousy of different cantons and towns, and the want of government aid all conspired to postpone and defeat a measure wished for by the whole people.

On the 6th of December, 1871, the company of the St. Gothard Railway was organized at Lucerne, with Dr. Alfred Escher as president. The company issued stock to the amount of 34,000,000 francs in £20 shares, and 68,000,000 francs in mortgage bonds.

The contract for the great tunnel was undertaken by L. Favre, of Geneva, supported by a company of well-known capitalists. He agreed to complete the work in eight years, forfeiting large sums of money for every single day's delay in the final completion. The work commenced on the north side of the Alps on the 4th of June, 1872, and at Arolo, on the south side, on July 2 of the same year. The undertaking was not more than fully under way when it was discovered that a tremendous mistake had been made in the estimates; it was found that the work would cost, if continued as projected, not 187,000,000 francs only, but 289,000,000; hence, a deficit liable to be on hand of 102,000,000 francs. Then came the crisis in the history of the road. All

sorts of bad results followed immediately. The stock of the company ran down to a minimum, and hundreds of families were nearly ruined by the collapse. The bonds shared in the crash; and even the most ardent friends of the enterprise feared that the money which had been so lavishly given was buried under the mountains forever. It became a question whether the work would not have to be abandoned There was but one choice, either to lose all that had been done or to add many millions more to the subvention.

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In the face of all opposition, however, and after surmounting many new obstacles, additional capital for the prosecution of the enterprise was secured. Some of the approaches to the great tunnel were abandoned, for the time reducing the expense. Germany, Switzerland and Italy added largely to their promised subventions, while leading Swiss railways and cities voted sums of money in proportion to the benefit they hoped to reap.

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The Gothard Railway proper extends from Immensee in Switzerland, to Chiasso in Italy, a distance of 113 miles. There are, in all, not less than fifty-six tunnels, comprising more than one-fifth of the whole line. Many of these tunnels are constructed in spirals to enable the road to make very great ascents within short distances. These spiral tunnels were the invention of Mr. Hellwag, the chief engineer. There are, besides those wonderful and difficult tunnels, many lofty viaducts, bridges, and complicated galleries. The main tunnel is 9¼ miles long, and others exceed 6,000 feet in length. There are, in fact, 23 miles of tunneling on this short line. The width of the great tunnel is 26 feet, and the height nearly 19 feet. At Airolo it is 3,756 feet above the sea. At Gaschenen, on the Swiss side, the elevation is 3,638 feet above the sea.

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The improved boring machines used for drilling the tunnel were driven by compressed air, produced by immense Gerard turbines. These turbines were driven by the rapid river Reuss. The compressed air was conducted from the compressors outside to the boring machines in the tunnel through iron tubes 6 inches in diameter. This air, escaping from the machines as they worked the drills against the face of the rock, served to ventilate the tunnel. At the north end of the tunnel the turbines delivered into the reservoirs over 3,500,000 cubic feet of compressed air daily, which, escaping at the drills, pushed back and out of the tunnel some 210,000 cubic feet daily, of bad gases and smoke. In spite of the escaping air, however, the ventilation of the tunnel remained bad. It was not the natural gases of the tunnel only, nor the presence of thousands of workmen and animals, but the hourly explosions of dynamite used in blasting, that made the tunnel almost unendurable at times. There were some fifty air-drills at work in each end of the tunnel constantly, being operated at seven points of attack; that is, in the main heading, and at points right and left further back, as well as on banks of rock behind, that were left when pushing the gallery forward. The main heading was worked on the Belgian system, viz., boring a hole some 8 feet square in advance, where the top of the tunnel was to be made. Often, too, this advanced gallery was finished up and arched before the bottom and sides of the tunnel were commenced or even excavated. The complete arch was usually put in in sections of 18 feet, and was always allowed a few days to settle before other sections were joined on. The advance made in the galleries at the heads of the two tunnels approaching each other (parties worked from both the Italian and Swiss sides) was usually about 21 feet for the two sides per day. The whole structure, as fast as excavated was lined with a circular wall, or tube, of masonry 18 to 30 inches in thickness.

The work was done principally by Italians. No other workmen would accept so much toil and danger for so little pay. Hundreds, possibly thousands, of these Italian workmen have been stricken down with diseases produced wholly by the bad air of the tunnel. They worked eight hours per day, receiving from 3 to 6 francs a day and boarding themselves. Of course the greater number received 3 francs only. They saved part of their wages, however, and sent it home to their needy families in Italy. Their food was extremely limited in quantity and wretched in quality. It consisted usually of nothing but *polenta*, or some meal porridge. The statistics show that 310 of these Italian workmen were killed by accident during the building of the tunnel, and 877 were wounded or received minor injuries.

The final cost of building the St. Gothard Railway and Tunnel, in accordance with modified forms, is now reported at something over 200,000,000 francs, not including the rolling stock and material for working the road.

On the 22d day of May, 1882, about ten years after the commencement of the tunnel, the festivities began in Luzerne in honor of its completion.

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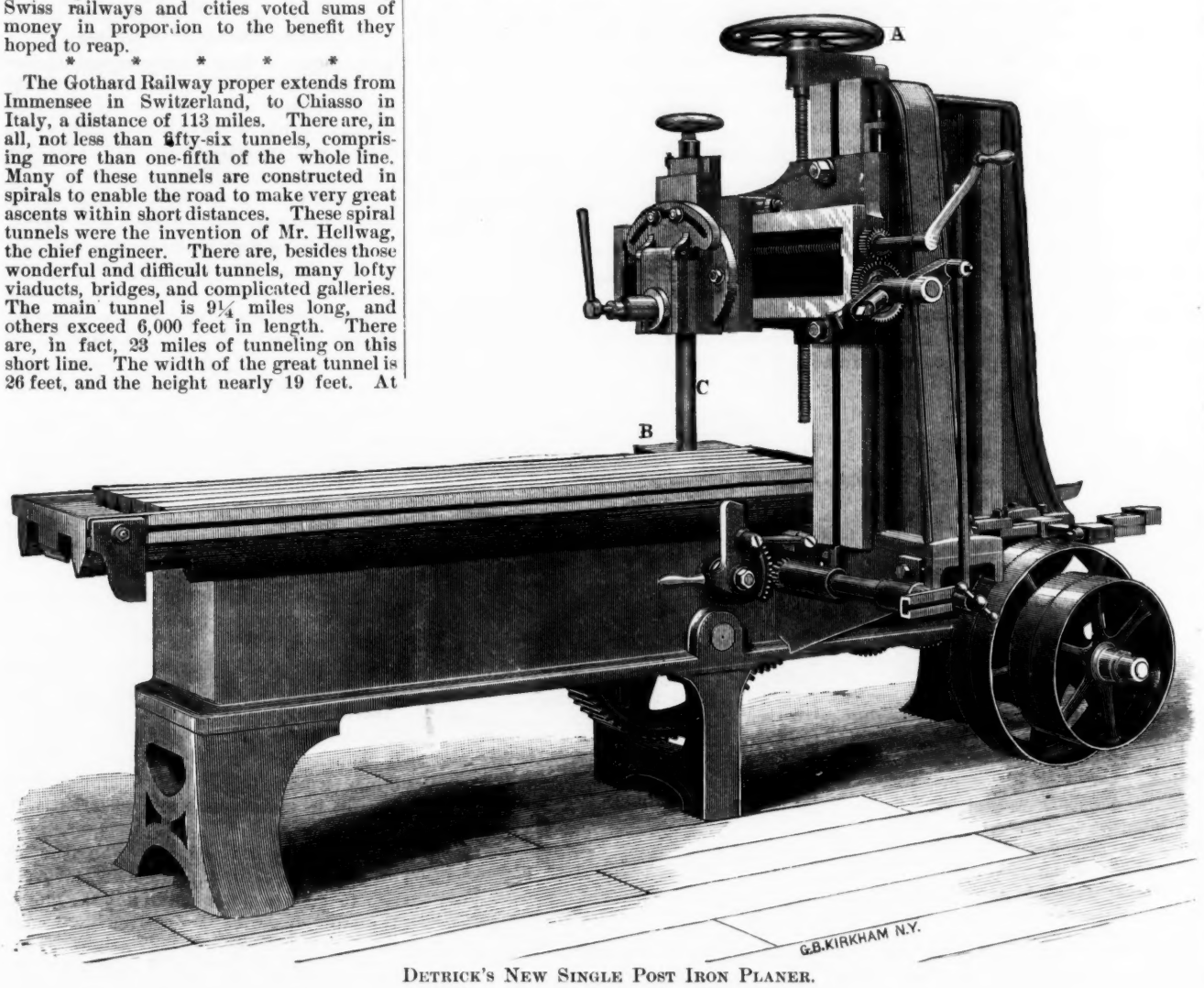
Passenger trains at once commenced running, and the tourist and goods traffic has already assumed immense proportions. The distance from Germany and North Europe has been lessened by at least thirty-six hours, while the conveniences and advantages to trade and travel by this Alpine line are almost beyond calculation.



DETRICK'S NEW SINGLE POST IRON PLANER.

Beneficial Results of Grumbling.

BY F. J. MASTEN.

Grumbling, it has been said, is one of the inalienable rights of man, referred to in the Declaration of Independence by the pursuit of happiness clause. It is pleasurable to flatter our pride by grumbling at the errors of others, when in the light of their experience the way has been made plain to us. We grumble at the weather, with unconscious pride in the importance of our own affairs, and we grumble at our work, as the readiest way of showing our superiority to it.

When the young machinist can grumble at himself, not for his want of knowledge and forethought, but in the pride of a resolution to do what he knows ought to be done, he is in a fair way to make substantial progress.

If a key forging is too small, or if too much is taken off in fitting, do not waste time with it, hoping that it yet may do, and then throw it away after all, or have the uncomfortable feeling of letting a bad job pass. Get a new key, or have the old one upset, as may be best. If the blacksmith grumbles, take all the blame on yourself. His pride may be touched by the supposition that he is in fault. Let him think that you do not feel yourself above making mistakes. It does not matter who is in fault; the fact that the key is too small, and that you want another one, is all that is to be considered.

I once wanted a 2″ chuck drill, and on going to the drill rack I found the 2″ drill with one lip broken off. I was a new hand in the shop, but I had already heard a great deal of grumbling about the disobliging ways of the tool-dresser. I took the broken drill and presented it for repairs. The blacksmith looked keenly at me, and said, "Did you break that drill?" "Why, yes," said I, smilingly. "Did you take me for a messenger boy?"

"Well," he grumbled, "you are the first machinist I ever knew to break a tool;" and then added, pleasantly, "but you are a new hand; you will soon learn." I never had any occasion to grumble about that tool-dresser.

In straightening a shaft for turning, have it right before beginning to turn it, rather than grumble afterwards at the iron for being crooked. Do not undertake a special and difficult job without preparing for it. If bolts, straps or clamps are needed, get them; they will come handy for other jobs.

Old Man Morton used to do a great many difficult jobs by stratagem, but the stratagem was always in preparing for the work; any of the men could do the work after his preparation.

The standard subjects of grumbling are the tools, and the way things are done in "this shop." I once thought the proprietor of a shop had things just as he wanted them. I think differently now.

In the shop where I was an apprentice, the foundry blower caused a good deal of grumbling. It was in the machine shop behind the big lathe, and it made a noise truly awful. The work it took to keep that blower and its belts in running order was a heavy tax on the proprietor as well as on the patience of all hands. All else had to be subservient to the blower. If more or less blast was wanted, all the other machinery had to run accordingly, and everything had to be stopped to put on and to take off the blower belts, and often to mend them.

Apprentices in small shops have to bear a lively hand at things which an apprentice in a large shop does not think of, and I had a good practice at those belts as well as in grumbling about them. I often resolved that if ever I had control of things I would have a better arrangement. I did not believe that other shops had things that way.

When I left the old shop—went out as a journeyman—I took notice of the foundry blowers, and generally found them tucked away in some hole or corner, up garret or down cellar, with shafting, pulleys and belts arranged as if the blower had not been thought of until the melter had his cupola charged, and then had been put up in time to take off the heat before night. Often the power required had been under-estimated, and generally, the prime moving belts were run at too slow a speed; the blower speed being obtained by the last belts. This made trouble with the prime moving belts.

Sometimes they were dangerously arranged. In one shop the belt run near a partition, and one day a man, in putting on the belt, got on the wrong side of it, and was jammed between the partition and the pulley, the rim of the pulley cutting him so that he bled to death in a few minutes.

In another shop, to put on the blower belt, a man had to stand on a cross timber, hold on to a truss-rod with one hand, reach out with the other and put on the belt, a set-screw in a slip collar all the time ready to draw his foot into a small space between the collar and the timber. One day my foot got in there. I hobbled on crutches, grumbled, and made up my mind how I would have such things arranged.

About two years afterwards I found myself in charge, with everything to be built new. I put up the worst blower rig that I ever saw. I pacified my conscience by trying to think that I had labored under difficulties, and that it was only a temporary affair, but I used it for several years, and left it a legacy to my successor—a testimony to the truth of: "Let not him that putteth on his armor boast, as he that taketh it off."

The next foundry blower that I encountered was overhead in the blacksmith shop.

Perhaps the arrangements otherwise were not beyond criticism, but I remembered with humility the blower I had left behind me, and grumbled as little as possible. One night a fire brought that blower down from its perch. Then I took a new blower, and a strongly built 6″x6′ straight-line engine, put them on the foundry scaffold, and belted direct from the engine to the blower. A well covered pipe from the boiler supplied the steam, which went into the cylinder free of the action of any governor, except the throttle, which was so arranged that it could be handled from above or below. This arrangement has been thoroughly tested, and is one about which I have never heard any grumbling.

The total assessed value of real and personal property in the State of New York is $2,783,682,567, or about $500 average to each individual of the population.

An effort is being made in Baltimore to establish an Industrial Exposition in that city on a large scale. A circular prospectus setting forth the need and advantages of such an exhibition is being circulated for subscriptions and signatures.

A second line of rails is to be laid through the St. Gothard Tunnel, making a double track the whole length.

Causes of Bad Vacuum.

[From the Mechanical World.]

Amongst the numerous causes tending to impair the effect of the vacuum in the condensing cylinder, first and foremost must be placed the admission of air into some part of the condensing apparatus. A joint may be drawing air somewhere; a small pin-hole, or a blown place in one of the injection pipes may be the cause; or a gland or stuffing-box may not be quite air-tight—in fact, a very slight admission of air, either into the condenser itself or the cylinder, will be sufficient to cause serious injury to the vacuum. This explains why, previous to indication, shrewd attendants almost always give an extra tightening to their packing, etc., in order to insure that no air may enter through the stuffing-boxes. It will be frequently noticed that the effect of the vacuum, shown on the indicator diagram, taken from one end of the cylinder is considerably better than on the card from the opposite end. Generally, the diagram showing the better vacuum is that from the back end of a horizontal cylinder, or the bottom end of a vertical cylinder. We have known this to frequently puzzle engineers when they have had a good vacuum in the condenser, but, as a rule, it will be found that the worst card is that taken from the end of the cylinder fitted with a stuffing-box, owing to air finding its way past the gland and packing. In a recent instance, where the vacuum at the back end of two large low-pressure cylinders was continually something like 2 pounds worse than at the front, it was found to be due to the piston rods, which were carried through the back end covers, having worn the hole at the bottom of the stuffing-box into an oval shape, and the packing could not, in consequence, be kept air-tight round the rods, although the latter were carried on a central slide behind.

A case which occurred in the writer's experience, some years ago, in the neighborhood of Manchester, affords a good illustration of what we have previously written respecting the fruitless expenditure so often incurred through bad vacuum. Difficulty was experienced in keeping a steam-condensing engine up to speed, and the difficulty kept increasing until it became absolutely necessary to "do something." The engineman was one who did not believe in the indicator. He preferred, he said, when an engine was going wrong, to "look into its belly." So he took off the cylinder-cover, and discovered, first, that the piston was defective, and new piston rings were required. When the engineer came to take particulars for the new rings, he found the cylinder required re-boring, as a cylinder in such a condition would soon spoil the new rings. Again, with the cylinder rebored, the old piston would be too small, and the wear would be all on the rings, so a new piston was ordered. When all this had been done, necessarily at great expense and loss of time, a start was made, but the difficulty of running full speed was still experienced, and the next outlay was in the shape of a new air-pump bucket and re-boring the barrel of air-pump, but still with no better result. The idea then occurred to the owners to call in a "man with an indicator" from a neighboring mill, much to their own attendant's disgust. The peculiarity of this case was that, for some time after starting, the engine bowled away at full speed without any difficulty, but soon afterwards began to lag, then "lost its water," and the steam could not be condensed. This occurred every time a stoppage took place. The application of the indicator showed for some time a steady vacuum of about 11lbs. This, then, gradually decreased, the back pressure becoming higher and higher, until the cold-water supply could not be maintained, and stoppage took place through the steam being no longer condensed. Evidently the trouble was due to the vacuum becoming somehow or other seriously impaired after the engine had worked some time. The next step was to disconnect the injection pipes and feed the condenser from the cistern with town's water, which was supplied to the cistern by hose pipe. By this arrangement a steady vacuum of 11lbs. was obtained in the cylinder, and the engine ran at its normal speed without difficulty. The injury to the vacuum having been thus demonstrated to be due to some defect in the injection pipes outside the engine-house, these pipes were ordered to be bared between the engine-house and the lodge or cooling reservoirs.

There being a length of something like 100 yards of pipe, buried some eight feet deep under buildings and crossing a public street, the place in which the pipes were most likely to be damaged was first selected for baring. This was in the mill yard, immediately under the place where the coals were in the habit of being "tipped" into the stokehole. After excavating to a depth of only some two feet, an enormous cavity was found in the earth about twenty feet in length by some six feet or seven feet wide and four feet in depth, and full of water. The pipes at this point being below the level of the reservoir, it was at once concluded that they were defective here, and the water flowed from the reservoir and filled the cavity. When the engine was started, the water was pumped out of the cavity, and so long as this supply lasted the vacuum was maintained and the proper speed kept up. It was then discovered that one of the injection pipes was fractured, the two parts of the pipe being completely severed, and thus the whole mystery was explained. The fractured portion of the pipe being below the water lodge level, every time a stoppage occurred water flowed into this hole; and hence, when the engine was started again after a stoppage, there was always for some time a supply of condensing water and a fairly good vacuum. A new length of pipe put everything right, and, had the indicator only been applied sooner, an almost useless outlay of between £100 and £200 might easily have been saved.

Cases similar to the above could be multiplied to almost any extent, but our space will not permit us to do more than refer to one or two others, showing where defects causing injury to the vacuum may most generally be looked for.

At a large cotton mill, only a few weeks ago, the vacuum in one of the condensing cylinders had gradually declined from 12½ pounds to 9 pounds, and on careful examination of the pipes and joints about the condenser, it was found that the continual rush of steam at a bend in the exhaust pipe had so wasted the metal that the pipe was full of small holes, through which air found admittance when the engine was at work, and in that way seriously impaired the vacuum. The application of a thin covering plate and an india-rubber liner, secured with clamps, caused an improvement at once of over 2 pounds in the vacuum, and the engine being a large one gave the firm the extra power they required, and obviated an outlay of some £250 or £300, which had been contemplated for new side pipes, cylinder slide-valves, etc. More recently still, in a case similar to the one first mentioned, where the engine after a time ceased to get its necessary complement of condensing water, the complete baring of the injection pipes led to the discovery of a fracture extending apparently half-way round one of the pipes close to the flange, and when the joint was disturbed the flange dropped off.

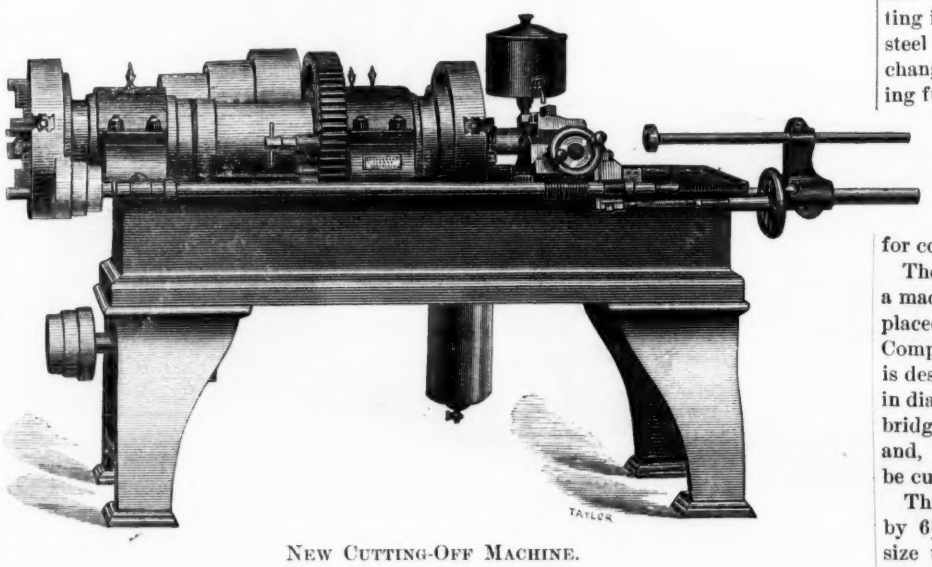
As the cold-water pipes are mostly buried in the ground, and are in places very inaccessible, it will be readily understood that the discovery of air leaks in them, defective joints, etc., must in many instances be a matter of very considerable difficulty especially when they have been a long time buried, and have become corroded and wasted. After the pipes have been bared the best mode of discovering the defective part is, probably, to cover them with water externally and start the engine, when the peculiar noise made by the air and water entering the crack or hole in the pipe will frequently indicate the exact locality of the defect. In some instances it may be discovered by sealing up the "rose," or outlet, of the cold-water pipes, and turning steam into them.

A serious loss from bad vacuum may be experienced through crippled and tortuous steam and exhaust ports and passages, and also from a restricted supply or too high a temperature of condensing water.

Attention, in the interest of the revival of ship-building, is called to the fact that it requires a very small value in the way of material for the employment of a large amount of skilled labor. This is certainly a strong point, and worthy of more consideration than it has usually received. Aside from this is the fact that large sums of money are made by the owners of both steamships and sailing vessels. The number of ships owned in the United States is comparatively insignificant, while the extent of ship-building in this country is at present about what it was 40 years ago, but less than one-half what it was 20 years ago. The reason for this is a subject well worthy of investigation, and if something can be learned by studying the advantages offered by European Governments for the benefit of their shipping interests, they should be carefully considered. What is wanted is the revival of ship-building, quite as much in the interest of skilled labor, which is constantly invited from abroad, as in the interest of ship owners.

The tariff of Russia imposes high duties upon complete machines, but only small duties upon the component parts. Machinery is, therefore, frequently imported "piecemeal" and put together in Russian shops. The government grants bounties to home manufacturers of locomotives. The National Exhibition at Moscow is said to present evidences of real and substantial mechanical progress.

According to the California *Architect and Building News*, all branches of mechanical operations in that State, especially in connection with house building, are on the full tide of prosperity.



New Cutting-Off Machine.

"In Australia the American makers continue to be very formidable rivals of the English manufacturers," says the correspondent of the London *Ironmonger*. "The light and highly-finished tools turned out by the American houses have met with considerable favor in Australia, and there are complaints on the part of English makers that the colonists will not buy English-made tools if they can by any means purchase American. One firm, whom I recently saw, informed me that they were successfully competing with the Americans in Australia. On my making inquiry as to how they were proceeding, they stated that they were 'copying the Yankees,' not only as to the style of tools, but also as to the coloring of them."

New Cutting-Off Machine.

The old time plan of cutting up stock for the machine shop by the use of the cold-chisel, as is well known, left the ends rough and made it difficult to properly center the pieces, and also introduced an element of uncertainty as to the exact length of the pieces when squared up ready for turning. These troubles were by no means overcome by the use of shears for the same purpose, which cut the ends at an angle, distorted them, and was, except perhaps in the saving of time in the cutting, no improvement on the cold-chisel. Again, if the stock is of a size to require heating, the expense of cutting is much increased, and in the case of steel the heating is open to the objection of changing the character of the metal, rendering future operations on it difficult.

The modern machine-shop practice is the use of the cutting-off machine for preparing stock, by which it is left of the exact length required, and the ends are also left in the best condition for centering and for future operation.

The accompanying illustration represents a machine of this class, just completed and placed upon the market by the Star Tool Company, of Providence, R. I. This machine is designed for cutting stock from ¼″ to 5″ in diameter, and for use in machine shops, bridge works, tube factories, iron works, and, in fact, anywhere that material is to be cut to lengths.

The spindle has a bearing 7″ in diameter by 6½″ in length, with a hole of sufficient size to take in 5″ round iron in the rough. It is strongly geared, and driven by a cone having three changes for a 4″ belt.

The counter shaft has double sets of pulleys, 12″ and 16″ in diameter respectively, thus giving six speeds to the spindle.

The machine is provided with Slate's cutting-off tool with two sizes of blade, and has automatic cross-feed and stop motion; also adjustable gauge, oil tank and dipper. When required, the machine will be furnished with centering attachment, by the use of which a shaft, after cutting off, can be centered without removing from the machine; also another cutting off tool and attachment at the other end of the machine, so that a shaft can be cut off and centered at both ends without moving.

This machine has a bed 5 feet long, 1 foot 6″ wide, and weighs 2,350 pounds.

Says the London *Ironmonger*: "The combination of asbestos with india rubber has been very successful in its application to valves of large size for steam, Mr. B. Rhodes, of Bow Road, the patentee, having successfully applied it to valves at the numerous chemical and color works that abound on Bow Common. The advantage of the material is its great durability under steam, as the heat does not affect the asbestos, and new settings can be readily applied without breaking any joints or removing the body of the valve—a point of great consideration where a large mill is depending on the steam-valve for motive power."

Capt. Shaw, of the London Brigade, says a steam fire-engine costs from three to five times as much here as in England. We believe the Captain is mistaken.

The application of electricity to governing engines, says the London *Ironmonger*, has been practically brought forward by Duncan Brothers, of Queen Victoria Street, who are now introducing a complete apparatus for closing valves or stopping steam-engines from any required number of points. The manager's room, the chief engineer's cabin, or any part of the workshop or engine-room can be fitted with it, or the captain on the bridge of an ocean-going steamer may be able to avert a collision by closing the valve instantaneously, or a timekeeper can stop the various engines from his office at an appointed hour. The apparatus consists of a cylinder attached to the head of a steam-valve with a supply of steam from under the valve ; the rack piston-rod is geared to a cogged wheel attached to the spindle of the valve, and, as the steam raises the piston, the cogged wheel rotates and screws down the valve, not too suddenly so as to jar the machinery, but yet very quickly. The steam is turned on by a weight lever or suspension rod, which is directly actuated by an electro-magnet, connected by wires to a Leblanche battery and to any required points, where the usual push-buttons are fixed. On pressing the button the apparatus immediately closes the steam valve. It has been applied to the cotton-mill machinery of Joseph Waide & Sons, at Bradford, and is being fitted to several factories in London, where it will be found useful in the event of a strap breaking or any accident occurring that might cause destruction to the engine if not stopped more quickly than by the ordinary method.

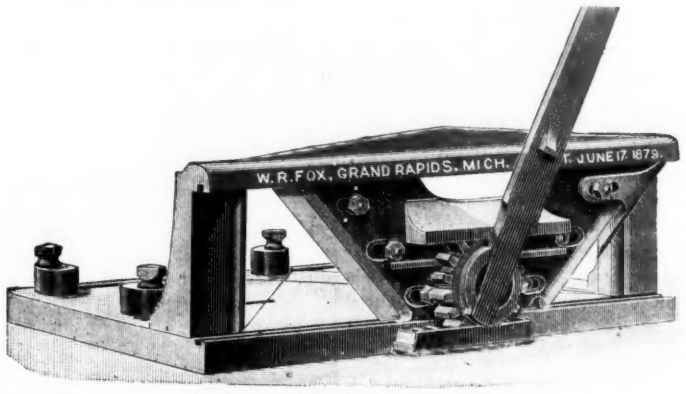
New Universal Trimmer for Wood-workers.

In various branches of wood-work it becomes necessary to trim the ends of boards across the grain and at different angles with the sides. This work is sometimes done with a plane and frequently with a chisel. Both of these ways are more or less unsatisfactory because of the lack of proper guides to steady the tools, in cutting; therefore, the angle is sure to be too great or too little to make a neat fitting joint, besides splitting or slivering the edge where the tool leaves the wood. In cabinet-making and pattern-making, which are probably the leading branches in wood-work, an exceptionally good mechanic is required to make a good, neat fitting joint. It was through a similar experience to the above that led to the invention and construction of the trimming device, shown in the engravings presented herewith. The perspective view shows an iron plate with a frame erected at one side, having a groove at the top and bottom for the reception of the carriage or slide which holds the knives. This slide is planed and neatly fitted to the grooves so that the steel knives, bolted to each end of it, stand precisely at right angles to the plate or bed, and are firmly supported.

The slide is moved by a pinion attached to a lever, as shown. It is of steel, has cut teeth, and is placed between two cut-racks, one upon the slide and the other upon the bed, as shown. It will thus be seen that a complete stroke of the knives (which have cutting edges inclined at an angle of 45° with the grooves in which the slide moves) may be made without lowering the lever below the edge of the bed. The pinion and rack motion gives a very powerful leverage, so that a clean, smooth cut is secured. The pinion is cast with a bevel core to receive the lever so that it may be removed when desired. By inclining the edges of the knives they make a drawing cut, and therefore do not require so much power as when placed square, besides the cut is made smoother. The edges are well protected by shields.

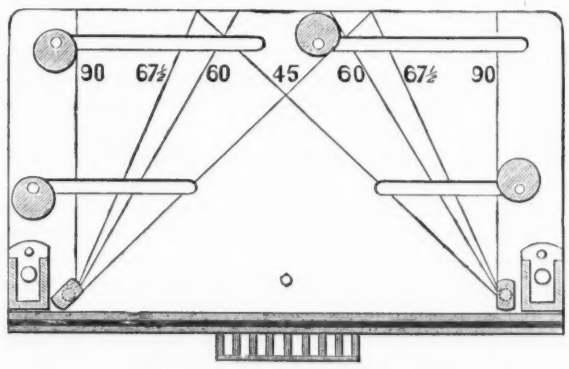
This will be easily understood by an inspection of Fig. 1, which represents a knife cutting square across a stick of timber. It will be observed that the stick to be operated upon is backed by a parallel strip of wood, so that when the cut is made the edge of the stick is not splintered. This operation may be quickly and satisfactorily accomplished with this trimmer, and is an operation which will be appreciated by every pattern-maker, particularly those who have to build up patterns. The trimmer will not only cut square, but will cut at any desired angle. How this is to be done may be seen by referring to the plan of bed, which shows a section of frame just above the bed with the slide and pinion removed. The bed is marked off into angles, as shown, and has four longitudinal slots having studs to move freely in them. These studs are made of steel, and are held in position by milled nuts at the top of square-headed bolts moving in the slots.

The adjustable posts for supporting the work while being cut are also of steel. By



Trimmer for Woodworkers.

setting the studs at any angle, the end of a stick of timber may be quickly cut to a corresponding angle. The cut made will be smoother and truer than can be made with either a block-plane or chisel. By the application of a gauge to the bed, any number of pieces may be cut to an exact length, or to the same bevel with each other. In making pulley patterns this is of special value. This is a marked improvement over the old style of *shooting board*. The size of the bed of this trimmer is 10″x18″, while the vertical space between slides is 4″. The stroke of knives is 7″, and the trimmer complete weighs 25 pounds. It is well made, and is very rapid in operation, requiring little mechanical skill to work it. The manufacturer is W. R. Fox, at the Michigan Tool Works, Grand Rapids, Mich.



Sectional Plan of Trimmer.

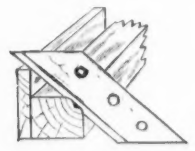


Fig. 1.

LETTERS FROM PRACTICAL MEN.

Cone Pulleys.

Editor American Machinist:

A few days ago I saw Joe having some trouble with his lathe belt. After a while he turned the belt inside out, and all went well again. I asked Joe why his belt worked better that side out. He said that the belt had stretched crooked; besides which it had curved to the crowning shape of the pulley, until it bore as hard at the edges as it did in the middle of the belt; and, said he, "The plaguey numbskulls who built the lathe did not know enough to groove the cone at the bottom of the steps, and the full side of the crook in the belt is carried so hard against the next step as sometimes to ride clear up upon it." By turning the belt over, the rounded part in the middle bore hard upon the crown of the pulley and relieved the edges. It would run a while in that way, and then would have to be turned back again, all for want of a groove $\frac{1}{4}$″ wide and $\frac{1}{16}$″ deep at the bottom of the steps of the cone.

Why tool-builders so often neglect so important and simple a point in cone pulleys I cannot understand.

Joe's lathe is not yet two years old, and is from one of the "crack" shops of the East. There is no mystery about the effect of the little groove. A belt does not go anywhere of itself. The surface in contact carries it always, and if the surface is cut out of the corner it will not be there to carry the edge of the belt against the next step.

Defiance, O. Old Jour.

Order and System in the Shop—Grinding Tools—English Machine Tools.

Editor American Machinist:

Order and system count for a great deal in a machine shop. Observe, on one hand, a shop where the mandrels are all steel with hardened ends, drills and bits to correspond, and with shelves to lay them upon, also places for bolts with the lengths and sizes marked and pins to hang dogs and clamps upon. Then, on the other hand, observe a shop run on the alter-any-mandrel-you-like principle, with all the bolts and clamps tumbled under the machine amid outrageous dirt and disorder visible everywhere. A man will accomplish far more work and with greater ease in the former.

No scarcity of grindstones ought to exist in a machine shop. There are many large shops where there is only one grindstone for machinists, pattern-makers, blacksmiths, and boiler-makers. The consequence is a man has often to wait five or ten minutes before he can get near it. It is a bad plan for a man to take a short cut by improper tool grinding, and then take his tools in the blacksmith shop to be redressed and tempered before they are half worn out. This plan wastes a great deal of time and steel. There is some excuse for frequent redressing when a man is turning old tires where they are so badly worn that they have flanges on both sides, and where the plentiful use of sand on the rail has made them so hard at the flange that the tools can't keep a cutting edge. Still if there were a large, coarse-grained grindstone near the lathe, driven at a moderate speed, with a proper rest to lay the tools on, there would be no reason why the workman should not be able to keep his tools ground the proper shape for cutting until they are worn out. He has plenty of time to grind while the lathe runs.

I was curious to see what English machine tools of the present day were like, and to see if they were differently constructed from what they were when I left England thirty-two years ago. I had read in the American Machinist of some imported machines which excited my curiosity, so I wrote home and asked my folks to write to Mr. Kennedy (a relative of mine), of the firm of Fairbairn, Kennedy & Naylor, of Leeds, in Yorkshire, requesting him to send me some photos of their tools. I got a splendid large album, with forty-four photographs of machines for locomotive and marine work. Some were entirely new to me, but the lathes do not differ much from what they were. They resemble New York tools, as a rule, more than those of New England. Their tool-holders are on the planing-machine principle, with compound slide rests. The loose head stocks, when above twelve inches, are furnished with rack and pinion and a projecting nut, so as not to have the spindle too far out. The fast head-stock admits a large cone and gear wheel. Conical journals are on the spindle, with steel-hardened bushes, flat ways, gibbed-down counter shafts, three small and three large pulleys. They have capital break or gap lathes.

Veteran.

Battery of Boilers.

Editor American Machinist:

The communication of "S. P." in your issue of September 9th, and A. F. Upton and C. C. Hill in that of the 23d, would indicate that neither of these correspondents has understood the object of my article regarding the misuse of the word "battery" as applied to a set of boilers.

My position is that the unauthorized, and, to my mind, entirely inappropriate application of the term, which has of late been made to some little extent in conversation and ordinary newspaper articles, should not be considered a justification for its use in a scientific journal which is a recognized mechanical authority, and in which accuracy of expression is particularly desirable, more especially to the unprofessional reader who seeks instruction in its pages.

I have been unable to find authority for the application of the term in any dictionary or text-book, either technical or literary, nor do the correspondents who differ with me offer any. As well might their taste incline them to term a set of boilers a "flock," a "group," or a "herd," and certainly such a designation would be quite as descriptive as that which they favor.

If the arbitrary use of any term that pleases the fancy is to be permitted in the discussion of mechanical subjects, we shall soon drift into the fearful and wonderful phraseology with which Mr. Keely describes his "motor." He tells us about "molecular dissipations," "impact of undulations," "reverberatory pulsations," &c., &c., and the mere fact that none of them have the slightest meaning to his auditors does not at all check his flow of language.

Let us be *accurate* in our expressions, and if new terms are to be coined, let them at least have the merit of being relevant and appropriate. Wm. Barnet Le Van.

Philadelphia, Pa.

Uncle Peter's Remarks.

Editor American Machinist:

As a species of introduction to this article, I would prefix the following :

There is but one Uncle Peter, and his aim is and always has been the welfare of machinists—particularly those of his shop, of which he is half owner and general superintendent. "My partner," as he calls him, is the other half, and the business manager of the firm. The relations between Uncle Peter and myself are those of master and privileged apprentice. Hence it is that he makes me a species of diary to which he communicates his opinions of shopmen and matters generally. This has led the men of the shop to give me the very peculiar title of "The Baby."

As I was cleaning the bench one morning I observed Uncle Peter coming through the shop, a pattern in one hand and a brace and bit in the other. As he laid them on the bench he remarked : "It does beat everything why some men never will learn to do a thing but one way. Just look at the draw plate in that pattern ; it has taken that fellow upstairs two hours to put it in, just because nothing but a square one can be driven into his head. Now just see how I make a draw-plate. Do you see this piece of iron ? Well, it's the cut from a flue sheet, and has a nice half-inch hole in the middle.

I'll just drill four holes around the outside and countersink for screws, tap the hole in the middle for a five-eighth screw, and it's ready to set in. Now I'll just set this extension bit to the right size, bore into the thickness of the plate and the thing is ready to screw into a first-class job in a quarter of the time it would take to put in a square one. There's that new man on the twenty-four inch lathe. I set him to turning up some inch set screws out of square inch and a half iron. Went over there and found him taking six cuts over them, with a tool that had the rake ground the wrong way. Had his lathe tool forged over and explained to him how to finish them in two cuts, ready for the thread. Not more than half the men know how to grind and set a tool so it will cut. Nine out of ten of them have too much clearance, and not enough rake. Guess if they had to pump the lathe by foot they'd learn something.

"There's that Smith fellow figuring to find out how much power it takes to remove a cubic inch of iron. Wonder how he'll do it, unless he gets some kind of regular tool and sets it in some kind of regular manner. Look at that gear-cutter. How much cut do you suppose there is to that thing? Not a bit—not a bit; it just grubs, that's all. Now if they'd just make these cutters with fifteen instead of sixteen teeth, and give one tooth right-hand, one left-hand, and one top rake till they got around, they'd have just five teeth of each kind, and the thing would cut, not grub. Now, I've got a cutter fixed up to my notion, and I'm going to try it on that gear."

Here Uncle Peter brought forth from his cupboard a gear blank and a cutter for four teeth, diametrical pitch, and going to the gear-cutter, proceeded to slash across the blank, an inch and a half face, at the rate of four revolutions to the inch, much to the secret admiration of THE BABY.

Weighing to the 100th Part of a Pound.

Editor American Machinist:

I take it for granted that what is generally termed a one hundred pound weight, weighs exactly one pound, which is the case in the instance of most light platform scales for general weighing.

Geo. Smith, who is employed in Mr. Aulman's shop, wishes to balance a pulley. He spreads clay on the inside of the pulley, on the light side, until it will stand in any position.

George now weighs himself, if he does not already know his weight, and he finds he balances the scales at 132 pounds. Before stepping off the scales he balances the clay on the 100-pound weight on the counterpoise, and proceeds to move the pee back on the beam to make the scales balance. He has moved the pee back to zero, and the beam is still too heavily loaded. He takes off the 100-pound weight—leaving the clay on the counterpoise—and moves the pee out to 97, when the beam will swing. Subtracting 97 from 132 leaves 35, which being divided by 100 gives $\frac{35}{100}$, or the part of a pound required to balance the pulley.

Without delay (George is not lazy) he goes to the blacksmith shop and picks up a piece of scrap, band, or strap iron, which his judgment tells him is surely heavy enough. He weighs this in the same manner and finds that it weighs $\frac{75}{100}$ of a pound. As it is a little more than twice as heavy as required he divides it near the middle taking $\frac{7}{16}$ in length. He does this with the shears, or with a good flat coldchisel and a strong, solid vise, and afterwards opens the vise a little way, supporting the iron on the jaws—unless he has something better—and with his hammer and a little common sense he shapes the iron to conform to the inside of the pulley, being careful, however, that the ends of the iron have bearing.

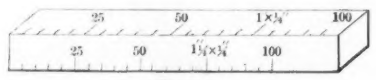
One of the several drilling machines is now brought into service, and a hole is put through the face of the pulley and one through the balance weight. A rivet well put in, and ten or fifteen strokes with a bastard file on out end of rivet finishes the job.

If this balancing business is large, a gauge may be used in connection.

Iron of the size $1'' \times \frac{1}{4}''$ will weigh $\frac{50}{100}$ pounds at the line 50 on top side of gauge. Iron of the size $1\frac{1}{4}'' \times \frac{1}{4}''$ will weigh $\frac{50}{100}$ pounds at the line 50 on front side of gauge, etc. This gauge is to be used to enable one to cut off any weight of band iron required, and of any size for which the gauge may be adopted.

One of the largest machine shops in the West uses cast-iron balance weights like that shown in cut, breaking off the end if too

BALANCE WEIGHT.



GAUGE.

heavy. The size of pulley which the weight will fit is cast in figures on inside of weight.

Let us return to the scale subject, and give an example showing how to use the idea in making an estimate on a contract job.

Mr. Grimes came into my office with a ½-inch blank nut in his hand; said he wanted 75,000 like sample; wanted to know what I could furnish them for. He said the nut was ½ inch thick, ⅞ inch square, with $\frac{7}{16}$ hole. By above method of weighing I found sample to weigh $\frac{9}{100}$ of a pound, and in less than a minute I found that 75,000 nuts like sample would weigh 6,750 pounds. Having obtained the weight, there was no difficulty to encounter, unless it was to state a price which would meet with Mr. Grimes' approval.

In large scales the ratio between platform and counterpoise, due to the combination of levers, may be found to be 1 in 200, 1 in 500, or 1 in 1,000, etc. This is readily determined by weighing one of the weights on the platform. Of course, if George had weighed his clay on scales the ratio of which was 1 in 200, his figures would have read $\frac{70}{200}$, instead of $\frac{35}{100}$; but I assure you that this would not have troubled him in the least.

J. E. MCCONNELL.

Des Moines, Iowa.

How to Spend a Morning Watch.

Editor American Machinist:

After reading Angus Sinclair's article on Motion Curves, I experimented as follows: The engine being vertical and direct acting, I lashed a board across the top of the cylinder, screwed my indicator into a hole at one end of this board, and screwed a pulley to the other end. The indicator stood above and just in front of the steam chest and in line with the valve stem. The indicator cord led from the air pump levers through the pulley to the indicator. I next clamped to the valve stem a wooden arm, and from this arm led to the indicator a slim stick, arranging a guide, and a hole for the pencil. All this was done while the engine was in motion.

In this way the annexed motion curve was taken. The cross lines represent the divisions of the stroke of piston in inches. When the cranks stand at right angles to the piston rod, the piston will stand two inches below its center of travel.

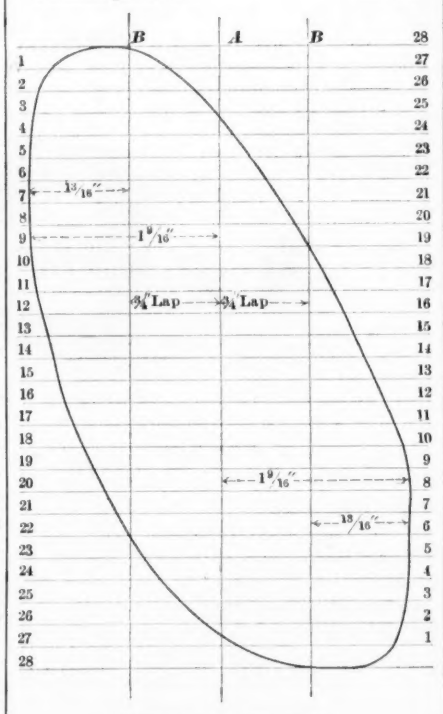
From one extreme edge of the curve to the other is the exact throw of the valve. When speaking of live steam, the curve represents the edges of the valve face, and when sp aking of exhaust it represents the edges of exhaust openings. The line *A*, is the center of throw of each edge of the valve face, and when the curve passes this line the exhaust opens and shuts. The distance that the curve makes from the line *A*, will be the width that the exhaust port opens. The travel of valve is $3\frac{1}{16}''$. Width of steam ports $1\frac{1}{4}''$. Width of exhaust port $3\frac{1}{4}''$.

The lines *B*, *B*, show the opening edges of the steam ports, and are $\frac{3}{4}''$ from the line *A*. This is the lap of the valve, and the only measurement required when taking the curve. Where the curve crosses the lines *B*, at the ends, it takes its lead, and where it crosses during the stroke the steam is cut off. The distance that the curve makes from the lines *B*, will be the width that the steam port opens.

It will be noticed that the steam follows longest, and the exhaust closes soonest, on the top, which is a bad feature with a vertical engine. The exhaust should close soonest at the bottom, so as to cushion the weight of cross-head and piston. The fault in this case is caused by using a rock shaft, instead of having the valve stem connected directly with the link-brass.

A curve was taken with the link well up. The steam opened $\frac{5}{16}''$, and was cut off 12″ from the bottom and 16″ from the top. The exhaust opened and shut 3″ from the bottom and 5″ from the top.

Philadelphia, Pa. S. D.



Compound Engines.

Editor American Machinist:

In the AMERICAN MACHINIST of September 23, "Anthon," under the above title, makes some statements which may fairly be considered as open to criticism, as well as others which may be intelligible to him, but are hardly understandable by the ordinary reader. When he ignores, as he does in his argument, the effect of cylinder condensation, it would seem that he gives away his case, since cylinder condensation is generally acknowledged (and undoubtedly by "Anthon" himself) to be the chief cause of the early limit to expansion. His statement, in effect that steam cannot be profitably expanded more than four times in one cylinder, is dependent on the very evil he ignores, and the ignoring of it removes the substance from his argument.

I believe it is generally conceded that by taking means to prevent condensation, even in part, expansion may be carried much further than this, and without taking some means to restore the lost heat, I think "Anthon" will not make a complete success of expanding steam of 60 lbs., absolute pressure, 16 times in two cylinders. The above-named statements are the ones that may be considered open to criticism.

With reference to his discussion of the gain by atmospheric pressure, all there seems to be of it is the gain from increased expansion. If there were more of it, it would only be necessary to infinitely increase the size of the cylinder to make an infinite gain. If the vacuum is perfect, it simply means that the resisting pressure is removed from the piston, and that steam, not air, can the more readily move it against the resistance of the load.

But the gain from this, whatever it may be, is neither 200 nor 50 per cent.; that is, not if this gain is referable to anything tangible. Of course, "Anthon" does not mean to assert that more fuel can be saved than would be required under any circumstances, and he ought to state exactly what he does mean.

His statement that "it costs more to keep up low steam than it does to keep up high steam," seems to be simply an argument in favor of higher expansion, or a smaller engine for the work, either or both of which are frequently advisable.

As to his assertion that the compound engine requires less work of the air pump, this is of course good for nothing, unless it is considered as demonstrated that the compound engine uses less steam in doing the same work than the simple condensing engine—something by no means yet made clear. FRANK GLEASON.

An Invention Wanted.

BY F. F. HEMENWAY.

A large proportion of all inventive energy—at least of that part of it which takes a mechanical direction—is in effect lost by being expended in the conception of things that have no economic or commercial value. The human mind inventive seems strangely given to making improvements that don't improve, and to devising something that has neither immediate nor prospective utility. This does not imply that the work of making such doubtful progress is not, judged by the character of the thought and the labor employed, in one sense of a high order, but it simply proves that such work is the result of misdirected efforts. It demonstrates that those who turn their attention to invention, like most others, are not able to see all sides of the subject clearly at the same time, or perhaps, as is sometimes claimed, that inventors as a class are more than most men, liable to have their energies so entirely concentrated in a special direction as to be unable to look with ordinary clearness in other directions.

It is useless to expect the quality of perfection in a machine, and somewhere on the road towards perfection efforts in that direction profitably cease; but the faculty of compromising in this respect is possessed by a few only, amongst whom inventors are not always found.

An inventor's attention may be attracted to some part of a machine that is not satisfactory in its operation, and nothing is more natural than that he will proceed to devise means to rectify that which is wrong, without much reference to any of the other parts. The undertaking may be of a magnitude to warrant a good deal of attention on his part; but, in any event, he is not liable to give much heed to the effects of his innovation on other parts, and perhaps, after months of labor and thought, he finds that his improvement, which makes the special feature all right by itself, makes the combination all wrong. Any one observing in such matters can call to mind plenty of inventions of this class, which, while they showed evidence of a large amount of talent on the part of the projector, were yet from the start, to nearly every one but the interested party, clearly worthless, as well as others that showed equal skill and ingenuity, but for which there was not the remotest possibility of a demand.

Two causes can be assigned for the seeming lack of ordinary good judgment on the part of the inventor, one of which is the habit so necessary to success of concentrating the attention on a single objective point, and the other; perhaps the principal, as it is the strangest one, lies in the fact that improvements are oftenest attempted by those not familiar with the special features of the subject. The Patent Office *Gazette* is gleaned by those who seek sport at the expense of the inventor, but usually with but little idea that the names of those claiming the inventions recorded belong to men who know but little of the subjects, except in a general way. It is said that any man can show an editor how to conduct a newspaper, the reason for which is just about as clear as it is why every one who knows nothing about a steam engine sees just how to improve it, or why the steam engineer knows more about the mysteries of a churn than he does about a steam engine.

This latter reason will go a good way towards accounting for the failure of nineteen-twentieths of the patented inventions of the day, but it will still leave a good many to be accounted for that come from those who

ought to, and who do, know better than they invent, if they give more thought to what they are *not* doing.

Invention is a good thing, although it is sometimes seriously intimated that the country is rather too much blessed in this direction. However this may be, it requires one other invention to satisfactorily straighten the whole matter. That other invention is a balance-wheel for inventors. Something that will keep them from running in the wrong direction, and keep them on reasonable time. There are a good many functions this balance-wheel should perform besides the ones specified. For instance, it should operate to restrain those who don't know anything about a machine from improving it too extensively. It might also be made to restrain those who know a good deal about a machine from improving it beyond the reasonable requirements of the circumstances.

Some one that never heard of a balance-wheel ought to set to work to invent one for the purpose; not to hinder invention, but simply to control and conserve the expenditure of inventive energy. What the results would be if this energy were all and always employed in useful directions, may be imagined but cannot be described. As it is now, we can only find consolation in the fact that, as nothing can be destroyed, this apparently unwisely expended energy still exists, somewhere and somehow, and may be working out unseen useful purposes. As it would be then (with this balance-wheel in use) we could enjoy the satisfaction of seeing it operate in specified directions, with accompanying results that can't be specified. By all means let us have the balance-wheel.

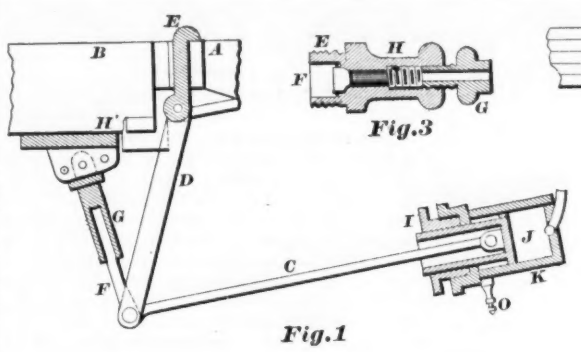


Fig.1

Fig.3

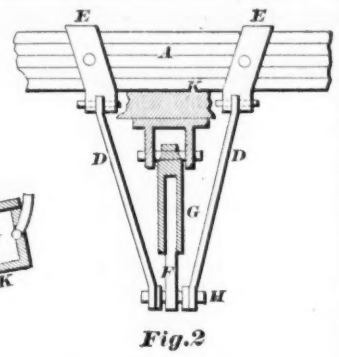


Fig.2

nized by some railroad engineers as early as 1837, when a portion of the weight of the tender was thrown upon the tail end of the locomotive to increase its tractive force. This device consisted of a screw passing through the tail piece of the locomotive and the draw bar connecting the locomotive and tender, so that by tightening the screw the front end of the tender was raised, throwing a corresponding weight upon the rear of the engine. These locomotives had but one pair of driving wheels with the axle at the rear of the fire-box. Wedges and blocks have also been used in place of screws for accomplishing this purpose. Draw bars have been used placed at an angle with the front end the highest, so that when the engine was pulling hard it tended to lift the front end of the tender pulling down upon the rear end of the engine. The amount of this force depends upon the power exerted by the engine in pulling, and upon the angularity of the draw-bar.

The objections to these devices, viz., screws, wedges, and blocks, have been that their effect is permanent, so that the additional weight upon the rear of the locomotive is used as much upon a level track, where it is not required, in proportion to the draft of the engine, as upon a grade. No provision is made for the great variation in the weight of the tender, which has been variously estimated at 100 per cent.; or, in other words, the load of coal and water placed upon a tender is about equal to the empty tender itself.

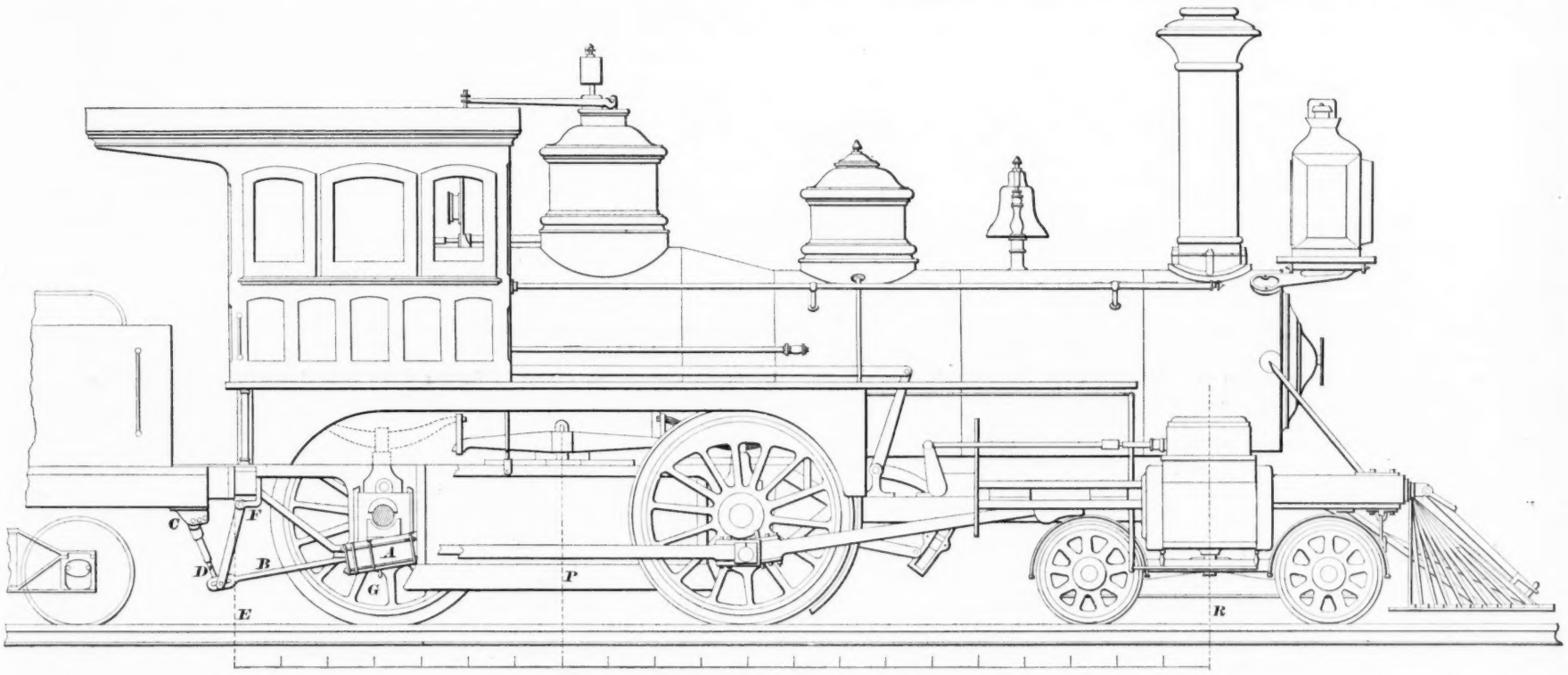
The angular draw-bar is also unsatisfactory in its operation, for the reason that it is uncertain, and depends for its effect upon the adhesion already existing in the engine. This may be made clearer by an illustration. When the wheels begin to slip their surfaces become glazed and lose about thirty five per cent. of their adhesion, which cannot be restored through the aid of the inclined draw-bar. In backing up, the angular draw-bar is a positive detriment, as it then pushes down upon the tender and lifts the rear of the engine.

As the sand-pipes are not in the rear of the wheels, no relief can be obtained from that source. What is wanted is a device that shall be simple in construction and can be applied instantly, in anticipation of a want of adhesion, as in nearing a heavy grade; then, when the grade has been surmounted, the device should be capable of removing the additional weight to enable the engine to run fast upon the level without excessive damage to the track. It is an established fact that the greatest damage done to the track and locomotives of the same weight is by running fast upon a level, therefore it is desirable to have the weight upon the driving-wheels, under such conditions, as light as possible, without impairing the adhesion of the engine in maintaining the high rate of speed.

The device herewith represented was invented by Henry Waterman, a locomotive and mechanical engineer of extensive experience, and is made by Frederick W. Richardson, Troy, N. Y. It consists of a steam cylinder *A*, attached to the rear of the boiler below the foot-board, the rear right-hand driving wheel and pedestal being removed to show the arrangement. This cylinder is connected with the boiler by means of a steam pipe, through which the flow of steam may be controlled by an ordinary globe valve within easy reach of the engineer.

To make the operation of this apparatus the weight of the front end of the tender is carried by the engine or up to the time when the stud *F*, *G*, reaches a vertical position; as a consequence, it therefore follows that the amount of weight or force transferred may at all times be regulated by the amount of steam admitted to the cylinder and is perfectly controlled by the engineer, as described. Compressed air may be used to operate this mechanism instead of steam, in which case the apparatus is somewhat modified, but the principle remains unchanged.

The device represented in Fig. 3 represents a relief valve, or water trap. It consists of a tube provided with a screw thread *E*, fitted to the steam cylinder at *G*, in the large engraving. A valve *F*, Fig. 3, is fitted and ground to fit the tube so as to open inward. This valve has a stem which projects through the bottom with a shoulder resting upon a spring *H*. The action of the valve is regulated by the nut *G*, by means of which the pressure upon the spring may be increased or diminished as desired. In practice, this screw is tightened so that it will require a steam pressure of 80 to 90 pounds to the square inch within the cylinder to close the valve, which remains closed while the apparatus is in operation. As soon as the valve is closed the steam pressure in the cylinder falls, so that when it only reaches 90 pounds the spring opens the valve, allowing the remaining steam and water to escape. Water from condensation is thus prevented from accumulating in the cylinder. Again, referring to the large engraving, it will be understood that the additional weight placed upon the engine should be as far back as possible, so that the augmented downward force may be as great as possible. This argument will be appreciated by an examination of the scale in the large engraving, where it will readily be seen that if the distance between *E* and *P*, is one-half the distance between *P* and *R*, each pound placed upon the tail-piece at *E*, will produce a downward force of one and a half pounds upon *P*, and an upward force of half a pound at *R*. In a practical test, by weighing a Hinkley 16"x24" locomotive upon a pair of scales, it was found that 4,250 pounds was transferred from the weight of tender to the rear end of the locomotive, making the engine weigh 6,150 pounds heavier upon the driving wheels and 1,900 pounds lighter upon the engine truck. This is about the proportion recommended in general practice. It may, however, be increased or diminished as desired.



WATERMAN'S LOCOMOTIVE ADHESIVE ATTACHMENT.

Waterman's Locomotive Adhesive Attachment.

With the rapidly increasing traffic upon railroads has also come the necessity of increasing the tractive force of locomotives.

Owing to the introduction of steel rails and steel tires upon the driving wheels the ordinary locomotive has sustained a severe loss of adhesive power. The hard, glazed surface of the rails and tires requires greater weight upon them to prevent slipping, particularly when the rails are damp or wet by rain or snow. Two methods have been employed to accomplish this end. One plan, and the one that seemed to suggest itself most readily to railroad men, was to increase the weight of locomotives. Upon many railroads this has been done, so that at the present time there are passenger locomotives upon some American railroads that weigh very nearly 100,000 pounds. Such locomotives are required to run at higher and more continuous rates of speed than formerly. The combination of these two elements, as the road masters say, "plays the mischief with the rails and road bed." The other method employed to increase the tractive force of locomotives has been by simple mechanical means to throw a portion of the weight of the tender upon the driving wheels of the locomotive when its natural weight alone was insufficient to start the train, then when the train was well set in motion to remove the surplus weight from the drivers where it is not needed and return it to the tender. By this means, as will be seen further on in this description, a great advantage may be had over the ordinary standard locomotive, both by increasing the tractive force of the locomotive in starting the train and by saving the track in running at high speeds. These advantages seem to have been recog

more clear, we refer to the enlarged views of details.

The steam cylinder *K*, in Fig. 1, is placed against the boiler, under the foot-board, for several reasons, viz., for convenience and to keep it from freezing up in cold weather, the heat from the boiler being sufficient to accomplish this. The piston *J* is more in the form of a plunger, that form being thought most suitable for convenience in packing. The packing is effected by placing fibrous packing in the stuffing-box and tightening the gland *I*. By admitting steam to the cylinder, the piston is forced outward, communicating its motion through the connecting rod *C* to the pin *H* in the swinging links *D*, thence to a jointed stud, consisting of the parts *F* and *G*. The part *G* is connected to the bracket *H*, bolted to the tender frame *B*.

The part *G* is permitted to swing in all directions, as will be observed. The upper ends of the links *D* are jointed to the brackets *E*, bolted to the tail-piece *A* of the locomotive, so that their lower ends are free to swing with the movements of the steam piston.

The jointed stud *G*, *F*, is composed of two parts, so that the jolting or pumping motion of the tender and engine will not be transmitted to the piston *J*, but will allow it to remain at rest.

Fig. 2 gives a rear and clearer view of this arrangement. The reader will now see that by means of the mechanism herein described the weight of the front end of the tender can easily and quickly be transferred from one to the other by the engineer, who simply opens and closes the globe valve in the cab.

The amount of weight transferred will be in proportion to the distance the piston travels in the cylinder up to the time when

---

The national council, Order United American Mechanics recently met at Wilmington, Del., G. H. Burton, of New York, presiding, and James N. Colely, of Philadelphia, secretary. The membership is 16,164. The receipts of subordinate councils during the year were: General fund, $127,873.23; widows' and orphans' fund, $4,047.50. Paid out for benefits and relief during the year, $66,701.39. Balance in the treasuries of subordinate councils—General fund, $273,932.30; widows' and orphans' fund, $69,643.10. State councils are in existence in Pennsylvania, New Jersey, Delaware, Maryland, New York, Connecticut, Ohio and Massachusetts, with subordinate councils in New Hampshire, West Virginia, Kentucky, Iowa and California.

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NEW YORK, OCT. 14, 1882.

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Unreliability of Water-power.

Water-power, on the ground of economy, may be desirable when it can be obtained with regularity. During the summer it has been so dry in the East that many mills and factories, depending entirely upon water-power, have been obliged to shut down until they could either put in steam engines or get a rise of water sufficient to turn the wheels. Within the last two weeks heavy rains have caused the water to come faster than it was wanted, and in many localities we hear of dams giving way and sweeping off entire mills or destroying other property of great value. Where the floods have not carried away dams or other structures, the "back-water" has caused stoppages about as annoying and expensive as a summer drouth. Prudent manufacturers who are about selecting locations for factories or workshops and the kind of power they shall use, are, in these days of progress and improvement, enabled to profit largely by noting the experiences of other manufacturers in this particular.

We have reached an era when a New England landscape is hardly considered complete without one or more mills, factories or shops standing out in pleasant relief. In New York, Pennsylvania, Ohio and other States stretching westward, hives of productive industry, depending upon one or another form of motive power, are becoming almost as familar as in New England. Rivers and smaller streams have been utilized to drive a considerable proportion of our industrial establishments from the period when the old wasteful steam machinery required ten pounds of coal for every horse-power per hour down to the present time when, with modern apparatus, two to three and a half pounds of coal for every horse-power per hour can be depended upon to keep running every day and every week. With the multiplying of factories has come a sharper and closer competition in their products. A fraction of a cent on each yard of cloth, pair of shoes, light tool or implement, makes a great difference in the power of competition and stands for a considerable sum in a year's business—often a respectable dividend on the capital employed.

The cost of a product depends largely upon the ability to run six days a week and fifty-two weeks a year (holidays excepted). In how many localities where water alone is used to drive the machinery can continuous running be relied upon? True, a shutting down of two weeks does not seem long, but it means a loss of one twenty-sixth of what is counted a year's production, while the interest on the cost of whole plant, salaries of superintendents and foremen, and other important expenses, go on the same as when in operation. With good engines and boilers such an idleness can be obviated. Neither a water-wheel nor a steam engine is absolutely proof against a break-down, but when properly constructed the latter can be relied upon against accident as well as the former. Water-power may sometimes be decided upon on the ground of cheapness (assuming that it can be obtained continuously), but as most desirable water-powers in the East are in the hands of parties who are bent upon making them yield all possible revenue, the saving over steam power is often more apparent than real.

Considerations of the kind we have mentioned are having much weight with those putting up mills and factories, and it has become nothing unusual to see steam power going into old establishments that have heretofore depended upon water, as well as in new ones that are built in a water-power neighborhood.

The next annual meeting of the American Society of Mechanical Engineers in New York City, November 2nd, promises to be fully as interesting as the previous regular meetings of the Society have been. The Society has grown rapidly during the past year, and a large attendance may be expected. Among the papers to be read is one by F. B. Allen, on the "Protective Value of Boiler Inspection," and one by C. C. Hill on "The Difficulties of Road Locomotion—Their Causes and Cure."

Utilizing Waste Power.

The operation of friction machinery, says a recent writer, has now become a fixed fact, and its easy adaptability where waste power can be utilized is a marked feature. A machine of this kind has come into use, which consists simply of an iron cylinder 1 foot long and 1 foot in diameter, having a fixed plate of hardened iron in one end, and a second plate attached to a revolving shaft, which presses lightly or closely upon the fixed plate, as circumstances require. The cylinder is filled with water, the shaft revolves, and from the friction of the plates the water in an incredibly short time is heated, and by means of steam pipes is conveyable to great distances for heating purposes. The machine is so constructed as to render it easily adapted to all places where there is waste power, as in mills, factories, public buildings, cars, etc. The power required for its operation is very slight; thus, to carry a machine with thirty-six square inches of friction plates—the ordinary size—one-horse power only is required, while a machine with 225 square inches of friction surface will require at most but six-horse power.

The above, which we clip from the *Age of Steel*, has, with some slight variations and an occasional amendment, been the rounds of the press during the past four or five years. The use of such a device was first advocated as a safe means of heating railway cars, but its scope—on paper—has been, as will be seen, extended indefinitely. Without denying the possibility or the propriety of using such a machine in special instances, the probability of its use to any considerable extent is not apparent. The average reader will be at a loss to know where there is much "waste power" (whatever that may be) "in mills, factories, public buildings, cars," &c. The burden of the item, which is in effect, that but little expenditure of power is required to obtain large results in the way of heating, is as apparent in its latter as in its former appearances, and, whether intended or not, is calculated to mislead. Altogether, it savors too much of the descriptions of the getting-something-for-nothing class of mechanism. Unless there is something magical about the "plates," nothing can be got from them except what is put into them, and if, for instance. a steam engine is used to furnish the power to revolve the plate, but a small percentage of the heat in the fuel burned under the boiler will ever appear as heat in the water; several times less than if the fuel were used to heat the water directly. Where water power is used for industrial purposes it is ordinarily fully utilized, and quite generally supplemented with steam power, and the attachment of heating cylinders, as described above, would result in a wasteful use of fuel. Heat may be transformed almost at will into its various forms of manifestation, but at a loss so far as any useful purpose is concerned; hence the economy of direct application when practicable.

Spenlow & Jorkins.

One of the most characteristic touches of Charles Dickens' genius was the description in his *David Copperfield*, of the manner in which business was done in the office of Spenlow & Jorkins. The affairs of the firm were conducted by Spenlow, the only outward evidence of the responsible existence of Jorkins seeming to be Mr. Spenlow's oft-repeated affirmation, whenever favors were asked that seemed objectionable, that "really he, (Spenlow) would be most happy, but he did not think that the consent of Mr. Jorkins could possibly be obtained. He therefore begged," etc., etc., the upshot of every such application being a mildly qualified, but decided refusal.

The deception embodied in this practice will not be defended in these columns, but it may not be amiss to draw a moral from even such an immoral proceeding.

Experience has shown, that, in business, and the affairs of life, divided responsibility is often the mainspring of success, since few men are singly equal to the task of saying 'no" on all the occasions when a negative answer would eventually turn out to be the best for both parties.

When a business man, for example, is asked to endorse another man's note or obligation, the sense of responsibility to those financially concerned with him, may wisely be called upon to act the part of the silent partner in the mythical firm of Spenlow & Jorkins.

When a manufacturer has spent years in the elaboration of a machine, and is asked by a querulous customer to make some whimsical alteration to meet his particular views, sober second thought may often derive a practical advantage from the fact, that the machine, so altered, is liable to find no more censorious critic in the future than the customer who finds that even with the alleged improvement, it has somehow failed to work as well for him, as it has done for others unaltered.

When a firm is doing a good business, and mistaking a temporary rush of orders for a "boom" that will never end, is tempted to erect additional buildings or launch out into improvements not warranted by its capital or the legitimate possibilities of its future, even a Jorkins may prove a godsend.

To carry the parallel a little further, when a man, whether employer or workman, is invited to indulge in incorrect habits or unwise expenditures, the query, "What would Jorkins say?" though Jorkins be at home and in petticoats, may evoke from the questioner's own thoughts just the right answer at the right time.

The firm, or individual, however, in whose matters Jorkins is the partner most liable to go wrong, or to counsel unwisely, is indeed one to be pitied.

Literary Notes.

THE BOOK KEEPERS' COMPANION; OR, BOOK-KEEPING SIMPLIFIED. By Thomas A. Lyle, Accountant. Published by J. G. Beidleman, 2028 Fairmount Avenue, Philadelphia, Pa. Price, 75 cents.

This little work consists of a chart or diagram put up in covers $3\frac{1}{2}'' \times 8\frac{3}{4}''$ for the pocket. The ingenious graphical chart represents the principles of posting and balancing at a glance.

The book-keeper can readily see from this chart, the proper head under which his entries should be made. Upon the back of the chart is a compendium or list of short, terse business rules for the instruction of book-keepers and beginners. This chart is not only valuable to the uninstructed, but is also valuable to the professional book-keeper in refreshing his memory upon rules upon which he has obtained little experience in the special business in which he is engaged. The rules may be committed to memory in a short time.

ROCKS, MINERALS AND STOCKS. By Frederick H. Smith, C. E. and Geologist. Published by the *Railway Review*, 182 Dearborn street, Chicago, Ill. Price, $1.50.

This very interesting little book begins with an enjoyable speculation of how the world began, and describes the formation of rocks, minerals, also upheaval and depression, with humorous illustrations. The formation of dykes and veins, as described, is very instructive, as also that of the prime minerals and rocks. Of the latter, the name, symbol and atomic weight of each is given, together with specific gravities. The formations are elucidated according to the best-accepted authorities. The second part embraces descriptions of minerals, describing the various processes adopted for the recovery of each, beginning with gold and silver, then taking up the industrial metals in their order. Coal and oil (carbon) are next considered, followed by descriptions of the industrial minerals and precious stones. The third part takes up and explains the formation of stock companies, how stocks are handled, and ventilates many of the tricks in stocks by which the unwary, and sometimes the veteran dealer, is fleeced. This part of the book is well worth reading, especially the *salting* process. The book is well printed on good paper, and is neatly bound.

The practice of carrying a very high steam pressure seems to be gaining ground in England. A firm at Kirkcaldy has recently finished the engines of a steamer named the Albertine, of the high-pressure compound three-cylinder type, the boilers of which

were blowing off at 150 pounds per square inch when the vessel left the quay at Kirkcaldy. The boilers were tested up to a pressure of 300 pounds per square inch.

QUESTIONS & ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

(346) J. B., Bloomingdale, Ill., asks: How much does air expand by being heated? *A.*—$\frac{1}{491}$ of its bulk for every degree of heat added.

(347) R. R., Latrobe, Pa., asks: Why do sea-going steamers have their funnels inclined backwards, instead of set vertically? *A.*—So that they may have a uniform rake with the masts; otherwise the general appearance would not be pleasing.

(348) E. A. K., Newark, N. J., asks: How can I blue quite a number of pieces of steel wire ⅛″ diameter and ¾″ long? *A.*—Heat in sand in an iron dish, keeping the pieces covered with the sand, and heating the sand evenly. When the pieces are of the right color, immerse them in oil.

(349) H. D. P., New Gloucester, Maine, asks: In what part of the mould should the metal be poured in casting small pulleys from 1″ to 6″ in diameter? *A.*—This question cannot be answered on general principles, but must be determined by the moulder from a consideration of the pattern he has to use, and if necessary he must experiment with a view to getting the best results.

(350) W. H. W., Easton, Md., asks: 1. What can I use to clean brass work on a steam fire engine? *A.*—A preparation considerably used for this purpose is made of: rotten stone 4 ounces; oxalic acid 1 ounce; sweet oil 1½ ounces, with turpentine enough to make a paste. Use the paste with a woolen rag, and rub dry with clean rags, or better still with soft leather. 2. What can I use to keep the brass work from tarnishing or losing its color? *A.*—You cannot prevent this.

(351) I. J. N., Gunnison, Col., asks: 1. Will zinc, or zinc and copper, placed in a boiler remove the scale and keep the boiler clean? *A.*—It will not remove the scale. Zinc is said by some to assist in keeping scale from forming on the sheets of a boiler, but it will not entirely prevent it. 2. What will clean a boiler and keep it clean? *A.*—We know of nothing that will entirely prevent the ormation of scale in a boiler.

(352) A. C. A., Tipton, Iowa, writes: I have charge of an engine and boiler which is used to run a sixteen-light Brush generator. The brickwork is laid close to the shell of the boiler clear over the top. I want to ask: 1. Would it be an advantage to raise the arch over the top, leaving a dead space of from six to ten inches between the shell and the arch? *A.*—We do not think it would be advisable to do so. 2. By so doing will the shell get too hot above the water line? *A.*—We think at times there would be danger of this. 3. Is it any advantage to wet the coal before firing? *A.*—Not unless you burn dust, or very fine coal.

(353) C. A. B., Kansas City, Mo, asks: 1. What will be the temperature of air compressed from dry atmospheric condition to 130 pounds per square inch? *A.*—Authorities differ widely on this subject. The temperature would probably be about 700°. 2. Can you tell the extent of expansion in the burning of ores in smelting processes. I want to exhaust the fumes, and I think I must provide for carrying off more than the blast? *A.*—This can be determined only by experiment. 3. Can you recommend a first-class book on foundations for engines and boilers? *A.*—We do not know of any book specially devoted to these subjects. 4. Does lowering the stern end of a propeller shaft increase or decrease the effect of the screw? *A.*—Within reasonably narrow limits we think the variation will be very slight. It will depend, however, something on the model of the hull.

(354) Mrs. Quirk, Chattanooga, Tenn., writes: A popular cook book says ice cream will freeze more rapidly in a warm room than in a cold one. Is this so; and if so, why? *A.*—We have not yet found anyone in the business of ice-cream freezing, who has observed that the ordinary temperatures encountered in their business have any influence on the time required for freezing. Since, however, the freezing mixture (salt and ice) must first melt, by which so much heat is abstracted from the mixture as to lower its temperature below freezing, it is quite probable that the temperature of the room might be so low as to delay the melting, and hence the freezing. It would seem probable that there is a temperature which is best for the purpose, and that an increase of that temperature, while it might hasten the melting and freezing of the ice and salt, would at the same time increase the temperature of the cream to be frozen, so as to more than off-set the gain. Similarly, if the temperature of the room is lowered, the melting and freezing of the salt and ice would be retarded, so as to lose more than would be gained by having the cream colder.

(355) W. P. C., Chicago, Ill., asks: 1. What wages can a first-class lathe or planer hand get in the East, say in Fitchburg, Lowell, or Lynn, Mass? *A.*—About $2.00 on an average. When a workman becomes established he can command more. 2. Can a young man (single) live there cheaper than in Chicago? *A.*—Good board can be had in the above named places at $3.50 to $4.00 per week. 3. Are the girls that work in the factories, in the above places as a rule, good, sensible, refined and industrial young ladies, or are they generally of the illiterate class? *A.*—This depends greatly upon the locality of the factory and upon the character of the proprietors. In almost all the factories you will find the rougher work is generally done by the rougher class of society, while some of the individuals employed upon finer work are ladies in every sense of the term. Your questions would seem to indicate that you are tired of single life and contemplate matrimony, which is an honorable step in all. We would advise you to take a reasonable time to make an acquaintance and allow a proper time, say two years, to elapse before a proposal of marriage. It is of the greatest importance for both parties that there be no deception practiced as it would be sure to affect their future happiness. The preferable course for you to pursue would be to so regulate your conduct and associations that you may be eligible to admission into the best society, where if you continue to be a true man your good qualities will be seen and appreciated. In this way you will make desirable aquaintances, and will have golden opportunities that would not otherwise come to you. Your chances for success in business, if you follow the above course will, probably be better financially where you are than they would be in the East.

BUSINESS SPECIALS.

Transient Advertisements, 50 cts. a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Thursday morning for the ensuing week's issue.

F. Samuelson, Pattern Maker, 38 Gold St., N. Y.

James W. See, Consulting Engineer, Hamilton, O.

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass.

Portable Forges, $10. Holt M'f'g Co., Cleveland, O.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N.J.

Hoerle Bros., Naugatuck, Conn. Small Dies and Special Tools to order.

J. C. Hoadley, Engineer and Expert, 29 High St., cor. Federal, Boston, Mass.

Howard S. Abbot, Solicitor of Patents, 617 7th St., opposite the Patent Office, Washington, D.C.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Latest and best books on Steam Engineering. Send stamp for Catalogue. F. Keppy, Bridgeport, Ct.

Foot Power Machinery, for workshop use, sent on trial if desired. W. F. & John Barnes, Rockford, Ill.

Pattern and Brand Letters. Vanderburgh, Wells & Co., corner Fulton and Dutch streets, New York.

Pattern Maker's Assistant. By Joshua Rose. 324 pages, $2.50 by mail, postpaid. Address orders, P. O. box 3,306, New York City.

A lot of 25″ lathes designed to equal the best Philadelphia tools, will soon be ready for delivery. Ohl & Co., E. Newark, N. J

Engine Lathes, Speed Lathes, Foot Lathes, Upright Drills, Light Drilling Machines and other fine tools, Frasse & Co., 62 Chatham St., N. Y.

"Steam Economy," 124 pp., cloth, $1.00, by mail, points out remedies for defects in engines. Best indicator practice. A. Wilkinson, 123 n. 4th St. Phila.

Wanted—A complete set of the Journal of the Franklin Institute. Must be in good condition. Address, with price, C. F., Box 7, office AMERICAN MACHINIST.

Wanted—A copy of Willis' Principles of Mechanism. Must be last edition in good condition. Address, with price, A. C., Box 2, office AMERICAN MACHINIST.

Mechanical Engineering.—To learn inventing, designing and construction of machinery at school. Address, S. W. Robinson, Ohio State University, Columbus, O.

"How to Keep Boilers Clean," and other useful information for steam users and engineers. Book sent free by the publisher, Jas. F. Hotchkiss, 84 John street, New York. Mention this paper.

We will pay 25 cents each for copies of the AMERICAN MACHINIST for January 1, 1881, which are clean and in condition for binding. American Machinist Publishing Co., 96 Fulton street, New York.

Russell & Struthers, Wax Process for making outline engravings. Specimens each week in the AMERICAN MACHINIST. We also do Map Engraving with best facilities. Russell & Struthers, 59 Park Place, New York.

Bound Volumes and Patent Binders. We can furnish Volume 3 of the AMERICAN MACHINIST, containing the full 52 issues of 1880, or Volume 4, containing the 53 issues of 1881, neatly bound in cloth, ready to ship by express, for four dollars. Either volume unbound, three dollars. "Patent Binder" for the AMERICAN MACHINIST holds 53 weekly issues in good shape. Sent to any address by mail for one dollar. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton Street, New York.

"Extracts from Chordal's Letters," the most interesting mechanical book published. A great variety of mechanical and business topics treated in a wise and witty way that will be instructive to old and young mechanics, and interesting to everybody. As many as 150 copies have been sold in a single shop. Over 40 humorous illustrations; 320 pages, 12mo. Price, $1.50 per copy, by mail, to any address. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton St., New York.

Rocks, Minerals and Stocks; by Frederick H. Smith, Consulting Engineer and Geologist. Contents: Part I. World Building, Prime Minerals and Rocks, the Formation; Part II. Gold and Silver, Industrial Metals, Coal and Oil, Industrial Minerals, Precious Stones; Part III. Stock Companies, Stock Dealing, Stock Tricks. *A vade mecum* for the use of everyone interested in these important topics. Scientifically accurate, witty, fascinating. *Sui generis* among technical books. Handsomely bound in cloth, $1.50, in paper, 75 cents. Order through your bookseller, or address The Railway Review, 182-184 Dearborn St., Chicago, Ill.

MANUFACTURES.

Baltimore is agitating the question of establishing sugar refineries in that city.

Dwight Slate, Hartford, Conn., has 26 hands at work on screw machinery, sensitive drills, and combination grinders.

The Cambria Iron Company, Johnstown, Pa., employ 12,000 hands, and the monthly pay roll amounts to nearly half a million dollars.

The Baltimore & Ohio Railroad Company will enlarge its shops at South Chicago, and make them the general headquarters of the west end.

D. Saunders' Sons, Yonkers, N. Y., have just sold a 12 inch pipe cutting and threading machine to Crane Bros. M'f'g Co., Chicago, Ill.

E. S. Stacey, Springfield, Mass., has made another addition of tools, and is now making a lot of twelve of his three and four upright spindle drills.

The new foundry of the Murray Iron Works, Burlington, Ia., is about completed, and will probably be ready to produce castings by October.

The Vulcan Iron Works, Toledo, O., are building a new boiler shop 100 x 80 feet, which they will fit up with improved machinery, including a power riveter.

The Michigan State Fair, at Jackson, has awarded the highest premium, with Gold Medal, to the Atlas Engine Works, of Indianapolis, for the best slide-valve engine on exhibition.

About 500 tons of steel is manufactured every 24 hours in the Bessemer steel works, at Troy, N. Y. As soon as the cold weather sets in the number of tons will be largely increased.

At Brockton, Mass., Goddard, Shaw & Co., machine tool builders, have dissolved, Geo. O. Goddard and F. L. Stone, retiring. The business will be continued by Mr. K. W. Shaw.

The Cleveland (O.) Twist Drill Company have issued a new catalogue and price list of twist drills, taps, reamers and milling cutters. They have given up the building of machine tools.

At Dayton, O., the Barney & Smith Co. have recently put in a new large steam hammer, and are running with 1,200 hands on orders for cars that are from four to six months ahead.

The Sullivan Machine Company, Claremont, N.H. are getting out $23,000 worth of machinery for the manufacture of asphalt pavement. This machinery will be shipped to Sydney, Australia.

The Dayton (O.) Lock Works is a company about formed for the manufacture of cabinet locks; capital $80,000 cash. All the skilled labor and machinery will be brought from the East. They will employ about 60 hands.

C. B. Rogers & Co., Norwich, Conn., have about 100 men at work building wood working machinery. They are now getting out a new iron frame tenoning machine and a new boring machine, also a new 16″ square planer.

The works of the Excelsior Iron and Brass Co., Cleveland, O., are fast approaching completion. They will be engaged in the manufacture of switch and car locks, water meters, model and experimental machinery, brass casting, &c.

The J. I. Case Threshing Machine Company of Racine, Wis., is about to commence the erection of another building in connection with its works. It will be a four story brick building, 135x120 feet. When finished it will be converted into a new machine shop.

W. H. Craig & Co., Lawrence, Mass., are now building for Starbuck Brothers, of Troy, N. Y., a hydraulic governor. It is to be placed in the works of the Albany & Renssalaer Iron & Steel Company. This concern already has six or eight Craig governors in use.

A company with a capital of $25,000 is being formed at Westfield, Mass., for the manufacture of various kinds of wire goods. The stock will largely be owned by Westfield men, who are now looking around for a convenient location on which to build a factory.

The New York, Providence & Boston Railroad Company are putting in two Improved Bucket-Plunger Steam Pumps, made by the Valley Machine Company, at Easthampton, Mass., to replace two of the old style pumps of same make which have been in use twelve years.

John H. Wright, Bridgeport, Conn., writes us: "I am still driving work. I have shipped this week two lathes, also a tapping and drilling machine. I have all the work I can do. I have lately sold lathes to the same parties to whom I sold a year ago. My planers are giving the best satisfaction. My new 14″ lathe takes well, and my friction clutch pulley gives entire satisfaction."

The oscillating steam engine made by J. W. Bocage & Co., Pine Bluff, Ark., seems to be meeting with considerable public favor. It is intended by Judge Bocage to build a new shop to manufacture the engines at Pine Bluff within a short period. A pair of these engines has just been placed on the largest ferry boat in the State, and a local paper says "they work like a charm."

Hill, Clarke & Co., of Boston, have a very extensive exhibit of machine tools at the New England Manufacturers and Mechanics Fair in that city, and another at the Cincinnati Exposition. They have issued a circular with a list of the tools displayed at both fairs, which will be mailed to any one on application.

Williamson & Barker, of Grand Crossing, Ill., are to build at once in connection with their foundry, a machine shop 60x70 feet. A large amount of machinery will be added to this department for finishing up castings, and the firm will do a general machinery business. With these improvements their facilities will be increased fully 50%.—*Chicago Industrial World.*

John Humphrey, Keene, N. H., is building a turbine water wheel 100 inches in diameter for parties in Lowell, Mass. Some of the work on this wheel being beyond the capacity of his tools, he has devised several cheap and efficient arrangements for accomplishing his purposes. Mr. Humphrey is also perfecting a machine for making excelsior for filling mattresses, &c., and is building rotary pumps and other specialties.

James Mahony, 73 Astor House, New York, has recently applied his Universal Patent Furnace to four boilers at Warren, Fuller & Co's Works on 42d street; also two at Saint Cloud Hotel, on Broadway; one at Grand Union Hotel, on 42d street; two at Women's Hospital, Lexington Avenue and 50th street; two for Naumberg, Kraus, Lauer & Co's Building on Broadway, and two for the Gutta Percha & Rubber Co., Franklin Avenue, Brooklyn, N. Y.

The buildings, lumber yard and railway sidings of the new Champion Harvesting Machine Works, Springfield, O., cover over one hundred acres of land. The main building is 615x55 four stories and basement, with five three-story wings 1000x55, exclusive of a five-story building for steel works, and their new rolling mills now being built 900x70 feet. The machine shop is fitted with the latest improved machinery, their orders of the Pratt & Whitney Company, of Hartford, amounting to over $200,000. Power is supplied by Woodbury, Booth & Pryor, of Rochester, engines and boilers, and a pair of engines with a plant of Babcock & Wilcox boilers.

The firm of Thomson, Sterne & Co., Limited, who recently acquired large works at Hollinwood, Manchester, England, has, at a recent meeting of the shareholders, resolved to increase the capital of the company, and alter its designation to "L. Sterne & Co., Limited." The new works are intended for the manufacture of gas engines and feed-water heaters, and the present establishment in Glasgow, for the purpose of making smaller sizes of gas engines, emery wheels, and spiral springs, etc. It will be remembered that Thomson, Sterne & Co., Limited, are the sole makers of Clerk's patent gas engine, which was awarded the Gold Medal at the Crystal Palace Electrical Exhibition of this year.—*Engineering.*

The Tremont Nail Company, Wareham, Mass., have applied the Jarvis system of admitting hot air into their puddling furnaces with entire success. The heat is increased with less waste of iron, taking less time and reducing the smoke to a minimum. Among boilers recently set on the Jarvis plan are three for the Holman Foundry, Worcester, Mass.; six for Allen Paper Car-Wheel Company, Chicago, (to burn Illinois slack coal); two for Taylor & Nichols, Westfield, Mass.; one (Corliss) for Slater Manufacturing Company, Pawtucket, R. I.; two for Freeport Water Works; one (Babcock & Wilcox), at Boston fair; one for J. L. Reynolds, Monson, Wis., and a "battery" of Corliss boilers for Wamsutta Mills, New Bedford, Mass. The last is a third order for the Jarvis setting.

Russell & Co., Massillon, Ohio, recently gave their employees a picnic and free excursion to High Bridge Glens, Cuyahoga Falls. The special train of twenty first-class passenger cars was loaded with employes and their families together with invited guests, all numbering over seventeen hundred people. After returning the workingmen held a meeting and adopted resolutions of thanks, one of which is as follows:

"*Resolved*, That this hospitable entertainment is but one mark of the kindly feeling existing between the company and its employes, and we take this opportunity to express our gratitude for this and many other favors bestowed by said company; and we here and now pledge ourselves to renewed efforts in their service."

The average number of employes of this company during the season was 450, and their average monthly earnings amounted to $25,000. The quantity of steel and iron consumed was 3,000 tons. The total value of all their productions for 1881, was $1,250,000, and for the present season $1,500,000.

Charles Churchill & Co., 495 Greenwich street, New York and 21 Cross street, Finsbury, London, E. C., is one of the oldest, largest and best-known houses in Great Britain, engaged in exporting and selling American machinery and tools to European customers. They have been in this line since 1862, and have just issued a complete illustrated catalogue of the best American tools and machines. It embraces 156 large pages. We notice that the catalogue was printed in Glasgow, and it is certainly a creditable work both typographically and mechanically. Its publishers believe it to be the largest and finest catalogue of American machinery and tools ever published outside of the United States. The superiority of American tools over those of English or German manufacture, is being widely recognized in Europe, and the export trade is constantly increasing. Among the houses for which Chas. Churchill & Co. are European agents we notice, the Pratt & Whitney Company, Brown & Sharpe Manufacturing Company, Morse Twist Drill and Machine Company, E. Horton & Son Company, A. F. Cushman, D. Saunders' Sons, F. E. Reed, Sweetland Chuck Company, Henry Disston & Sons, and the Stanley Rule and Level Company.

Machinists' and Engineers' Supplies.

NEW YORK, Sept. 28, 1882.

Although there is a fair amount of business being transacted in supplies, yet the condition of trade has not improved as was anticipated a month ago. The small orders indicate a conservative policy on the part of the buyer. The manufacturers are all busy and many of them are still behind their orders. No immediate changes in prices are expected, present prices continue firm.

James Beggs & Co., 9 Dey street, New York, have just received a full line of Gardner governors. This is the first time they have been able to obtain a good stock of all the different sizes owing to the press of orders upon the manufacturer.

The Babcock & Wilcox Co., 30 Cortlandt street, New York, are preparing to manufacture their sectional boilers in sizes of 25 and 50 horse power, also other small sizes for which there is an increasing demand. Heretofore their boilers have all been of larger sizes.

Iron and Metal Review.

Business in the Pig Iron line continues to move along about the same as last reported. Demand and supply are about evenly balanced and buying is of moderate proportions and no extra stock is carried by consumers. We quote prices as follows: Foundry, No. 1, $25.50 to $26; Foundry, No. 2, X, $23.50 to $24 50; Grey Forge, $20.50 to $21.50. There is a moderate inquiry for Foreign Iron with prices steady. Some brands are relatively higher than last week owing to some difficulty in delivering from furnace. We quote Coltness at $26.50 to $27; Glengarnock, $24 to $24.50; Gartsherrie, $25.50 to $26; Summerlee, $25.50 to $26; Carnbroe, $24; Eglington, $23.75 to $24; Langloan, $25.50 to $26. Wrought Iron Scrap moderately steady at $28 to $28.50 ex. ship and $29 to $29.50 from yard. Steel and Iron Rails are getting more active. Steel for next year's delivery, it is said, can be bought at $43, while the general price is $45. Old rails quiet but steady at $30 to $30.50 for double-heads, and $27 to $27.50 for Tees. Merchant Bar is very scarce the card rate at mill being 2.6c. and 2.7c. at store. Copper is in light demand at 18¼c. to 18¼c.; Banca Tin, 28c; Straits and Malacca 25½c to 25¾c.; Billiton, 25⅝c.; Australian, 25⅝c to 25½c. Lead, Common, 5.15c.; Refined, 5.15c.; Antimony, Hallett's brand 10¾c. to 11c.; Cookson's, 13c.

WANTED

"Situation and Help" Advertisements, 30 cents for each seven words (one line) each insertion. Copy should be sent to reach us not later than Thursday morning for the ensuing week's issue

Wanted—Situation as assistant engineer or first class fireman. Address, "C," this office.

Wanted—Situation as Engineer by competent engineer and machinist. Address D, this office.

Wanted—a position as foreman, by a practical machinist, tool maker and die sinker. Address P. O. 474, Rome, N. Y.

Wanted—A situation in some good engine shop as brass moulder. Good reference given. Address, J. L. M., Box 754, Lockport, N. Y.

Wanted—Situation by a first class pattern maker, 16 years' experience. Will go anywhere. Address, R. A., Box 5, AMERICAN MACHINIST office.

First-class pattern maker wants job. N. Y. City or vicinity preferred. Can give best of reference. Address, Pattern Maker, Box 379, South Norwalk, Conn.

A man of experience with steam engines and general jobbing, wants a situation to take charge of work. Correspondence solicited. Address, Box 503, Defiance, O.

Machinery designed, construction superintended, leveling, Patent office drawings, copying and tracings. Charges reasonable. Wm D. Skidmore, M. E., 367 Nostrand Ave., Brooklyn, N. Y.

To Capitalists.—A leading draughtsman and superintendent wishes to meet with suitable opening. Could introduce new lines of business if required: accustomed to engines, steam cranes, tools, &c. Address, Philada, care AMERICAN MACHINIST.

Wanted—Situation as Superintendent or Assistant Manager in an established manufacturing company, by a thoroughly competent party who has held similar positions. Address, Manager, 31 Jefferson St., Brooklyn, E. D., New York.

A young man who has been in business and compelled to withdraw through partnership difficulties, would like to do something better than work at the bench. Is used to Sewing Machine and Electric work. Address, Toolmaker, AMERICAN MACHINIST.

Wanted—A machinist able to manage a small jobbing shop running on light fine work, may buy an interest in an established and well located shop, or the whole will be sold. S. McHenry, 927 Filbert St., Phila.

Wanted—A practical machinist, must be a good draughtsman and acquainted with steam engines, pumping and general machinery, as superintendent of works located in Conn. Address, for thirty days, with references, "Steam," Box 1057, New Haven, Conn.

Wanted—By a mechanic who has a large machinery correspondence on a line that is in constant demand, some machine shop to manufacture for him. Can give employment to 20 or more men. For particulars address, Thos. Rich, Lock-box 259, Lockport, N. Y.

Wanted—500 feet of 42-inch diameter old boiler shells. Address, P. O. Box 1208, New Haven.

Forty-inch Hewes & Phillips screw cutting crossfeed lathe for sale. With raising blocks to swing 52", and 4-jaw chuck. George A. Ohl & Co., East Newark, N. J.

Second Annual Exhibition Fair

OF THE

New England Manufacturers' and Mechanics' Institute

IS NOW OPEN IN BOSTON.

The largest exhibition building in the United States. Ten acres of industrial exhibits, displaying the wonders of mechanism, Science and Art. The largest display of Machinery since the CENTENNIAL, all in operation, and showing the processes of manufacture. **Carpet Weaving, Cotton Weaving, Silk Weaving.** The great railroad display of Atlanta duplicated. The leading industries of the North, South, East and West fully displayed, making a NATIONAL EXHIBITION.

DON'T FAIL TO VISIT THE EXHIBITION FAIR.

COOKE & CO., FORMERLY COOKE & BEGGS,

Dealers in MACHINERY AND SUPPLIES.

6 Cortlandt Street, New York.

AGENTS FOR

The Waters Perfect Governor,

Having Adjustable Speed, Automatic Safety Stop, Sawyer's Lever, and Solid Composition Valves and Seats.

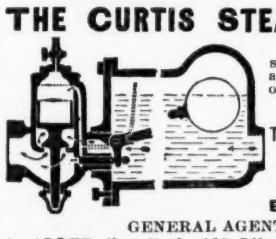
ALSO,

SUPPLIES

For Machinists, Railways, Mills, Mines, &c.

Please send for circular and state that you saw the advertisement in this paper.

THE CURTIS STEAM TRAP.



Send for Circular stating advantages and superiority over other traps.

Manufactured by

THE CURTIS REGULATOR CO.

51 Beverly St.

BOSTON, MASS.

GENERAL AGENTS:

A. ALLER, New York, 109 Liberty St.
JOHN McKAY, JR., Philada., 135 North 3d St.
EDW'D J. MOORE, Baltimore, 8 South St.

JENKINS PATENT PACKING
THE STANDARD
MAKES A PERFECT JOINT
JENKINS BROS. 71 JOHN ST. NY.

JEROME B. SECOR,

MANUFACTURER OF

Machinery and Tools,

IMPROVED WIRE FEED SCREW MACHINES, GUN AND SEWING MACHINE TOOLS, DIES FOR DRAWING, FORGING, BLANKING, &c., MADE TO ORDER.

Manufacturer of

THE SECOR SEWING MACHINE,

Factory Cor. Broad & Railroad Ave.

BRIDGEPORT, CONN.

Wanted—To arrange with the right parties for the manufacture on royalty or otherwise, of a first-class automatic cut-off engine. Address, Box 10, care AMERICAN MACHINIST, 96 Fulton street, New York.

JOHN H. WRIGHT, BRIDGEPORT, Conn.

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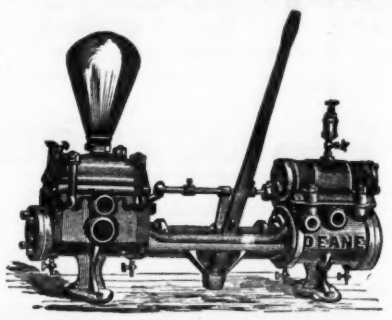

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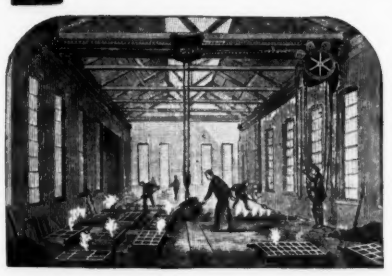

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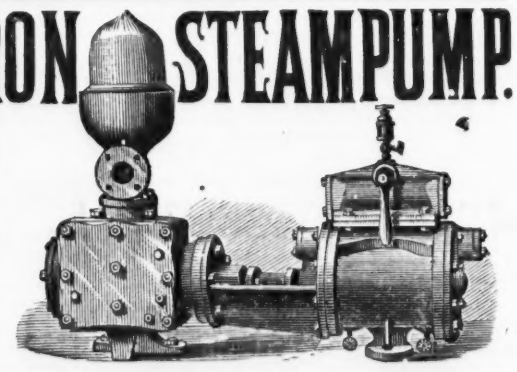

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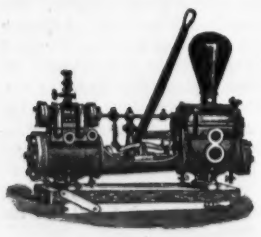

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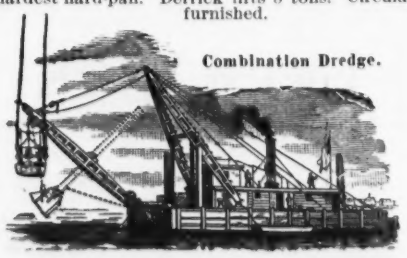

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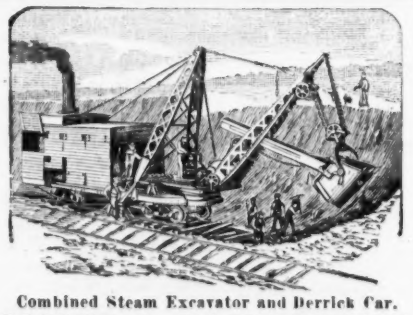

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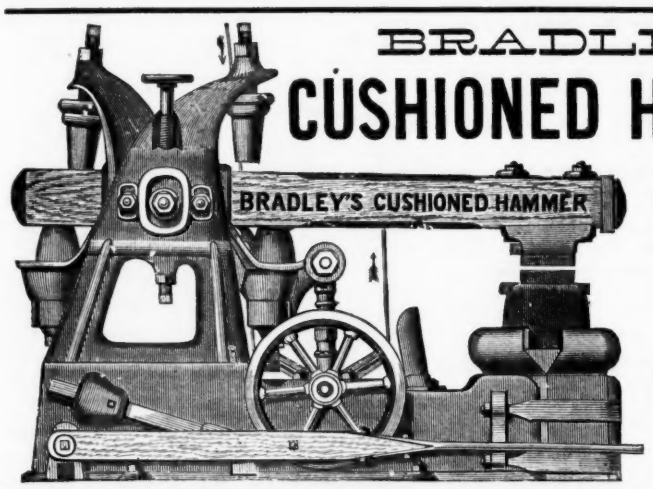

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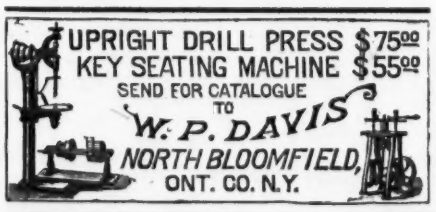

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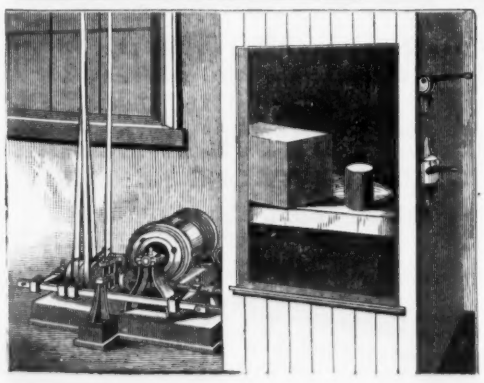

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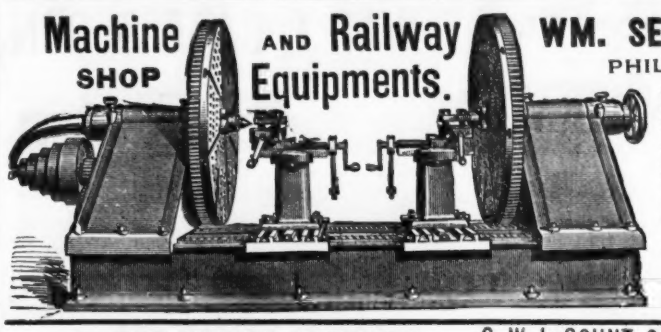

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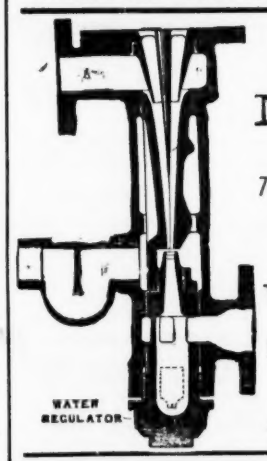

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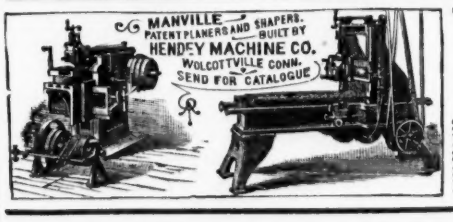

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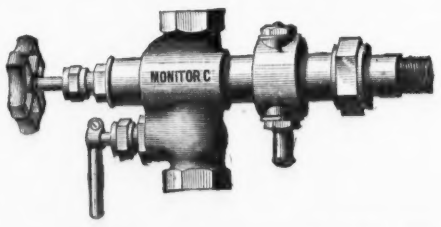

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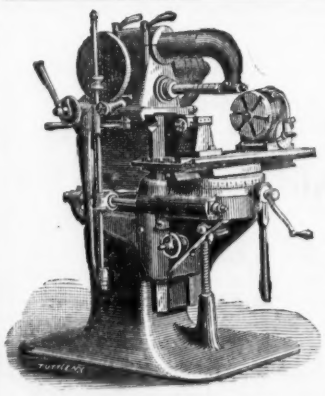

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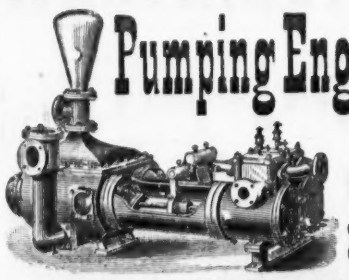

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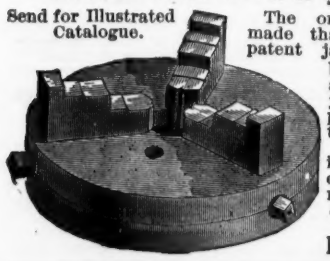

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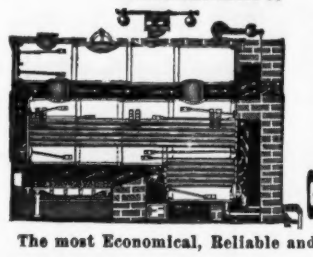

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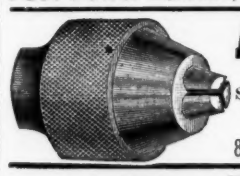

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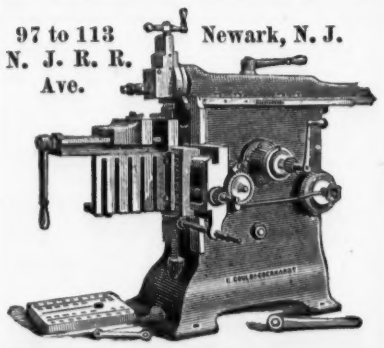

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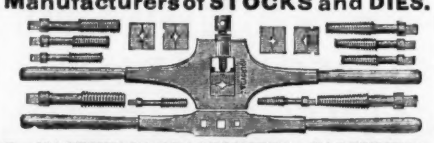

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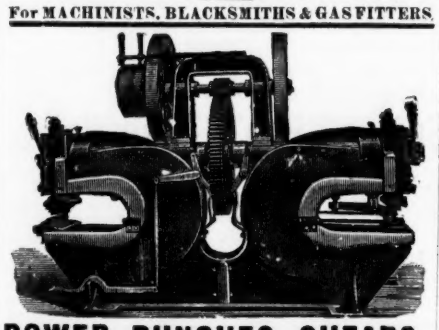

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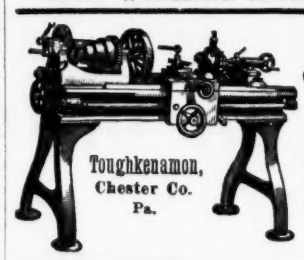

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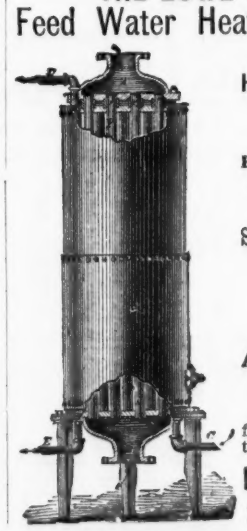

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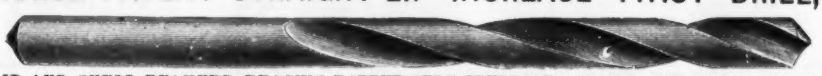

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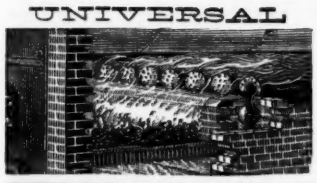

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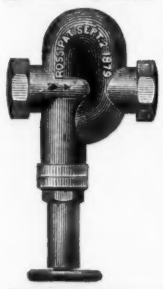

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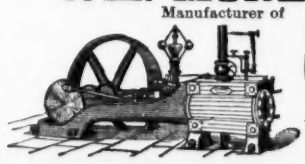

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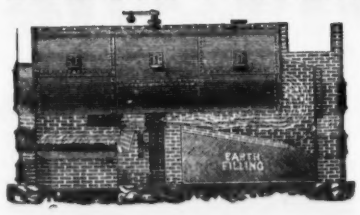

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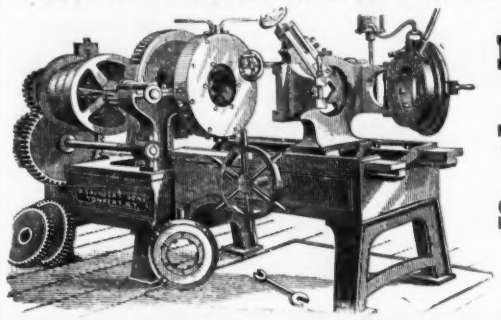

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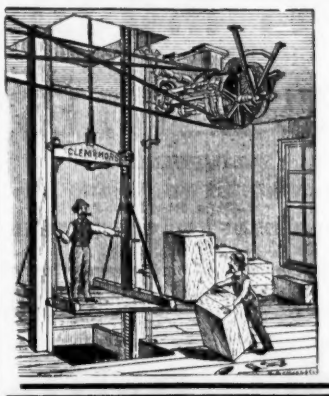

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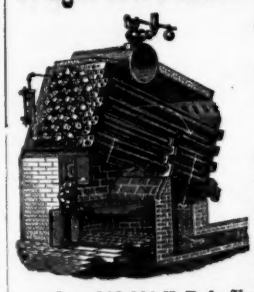

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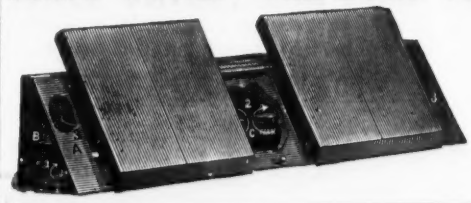

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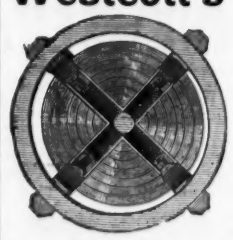

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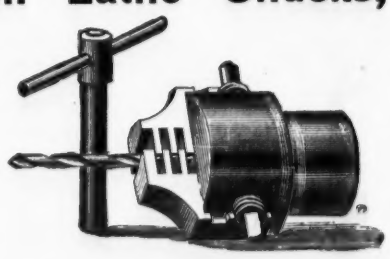

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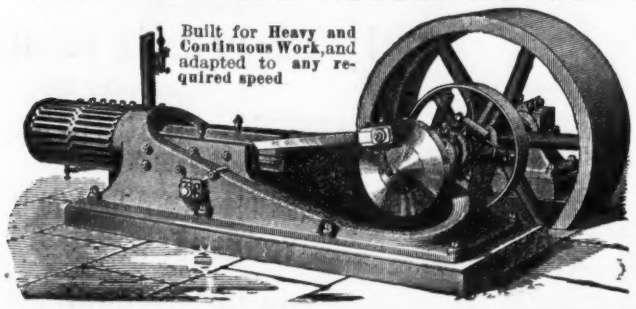

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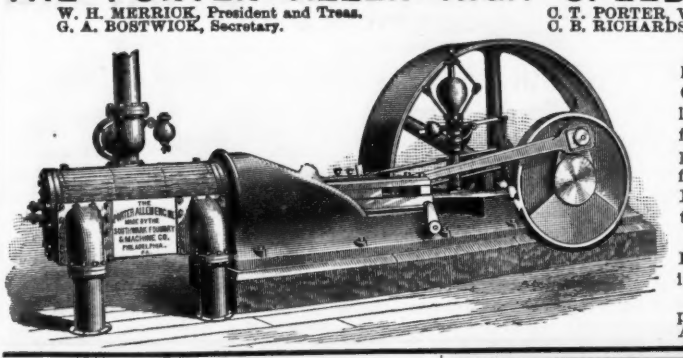

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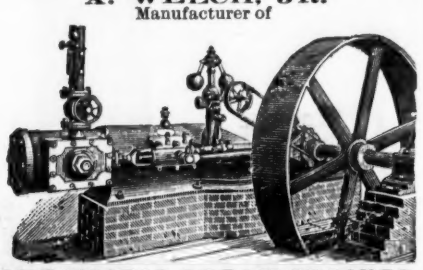

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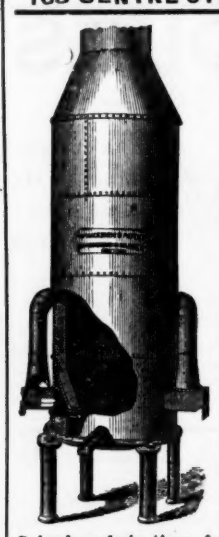

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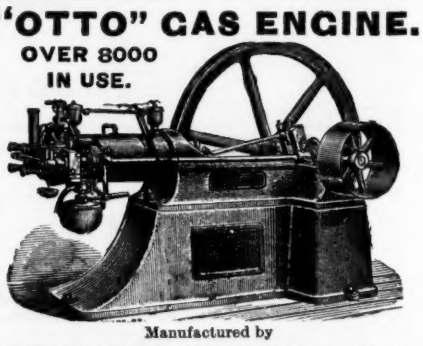

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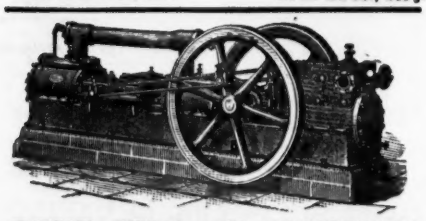

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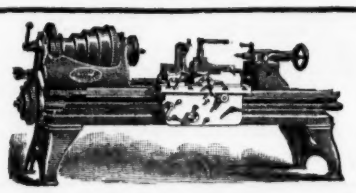

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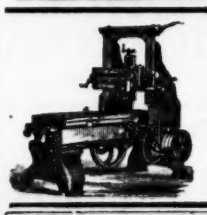

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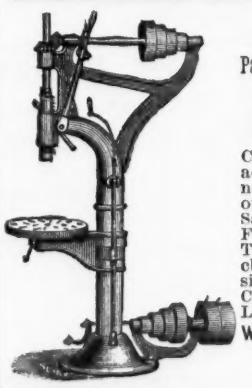

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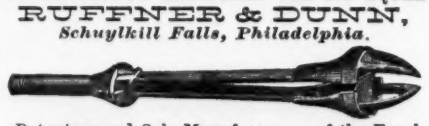

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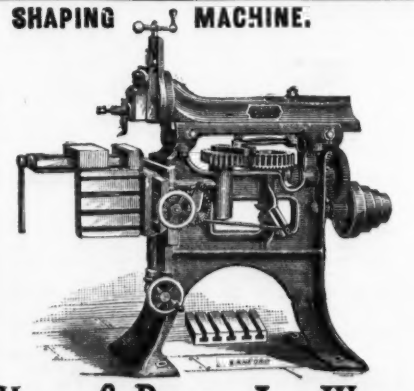

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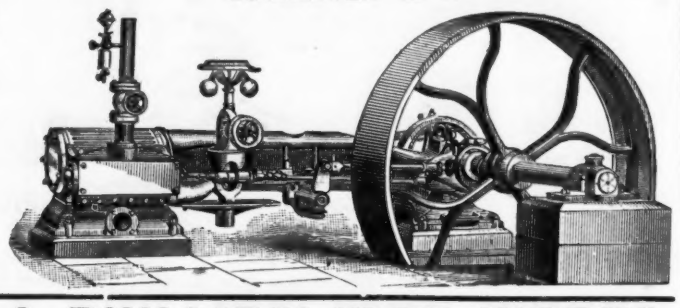

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20 "	"	12 "	Fifield.
19 "	"	10 and 12 "	Gray.
18 "	"	10 and 12 "	Blaisdell.
17 "	"	6 "	Johnson.
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36 inch x 36 inch x 9 ft., planer.	2d hand, good order Wheeler.
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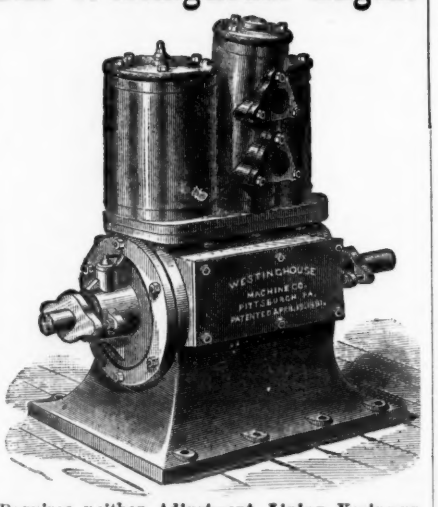

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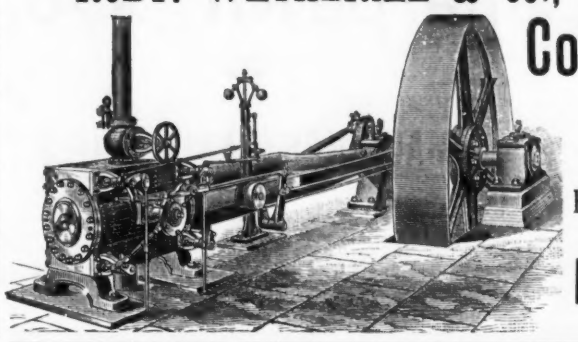

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1 " "	15 in. x 6 ft.	"
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1 " "	18 in.x8 & 10 ft.	Lodge & Barker "
1 " "	24 in. x 12 ft.	Perkins "
1 " "	30 in. x 16 ft.	" "
1 " "	22 in. x 10 ft.	Fifield. New.
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1 30 in. "		" " "
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1 28 in. " "		" " "
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2	22 in. " 12 ft.	" " "
1	19 in. " 8 ft.	" " "
2	18 in. " 8 ft.	" " "
1	17 in. " 10 ft.	" "
5	15 in. " 6 ft.	" " "
1	12 in. swing, 6 ft.	Hand Lathe. New.
1	10 in. " 4½ ft.	Bed Hand Lathe. New.
1	38 in. x 10 ft.	Planer. New.
1	38 in. x 12 ft.	Planer. New.
2	30 in. x 8 ft.	Planers. New.
1	26 in. x 7 ft.	Planer. New.
1	26 in. x 5 ft.	" "
1	22 in. x 4 ft.	Planer. New.
2	38 in.	Swing Upright Drills. B. G. & S. F. New.
1	26 in.	Drill. B.G.&S.F. New.
1	23 in.	Drill. B. G. & S. F. New.
1	23 in. "	Plain.
3	20 in. "	"
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1	3 "	" "
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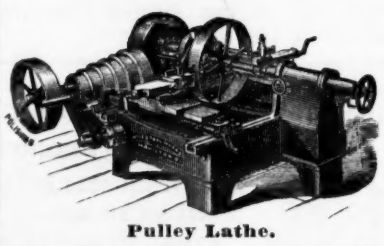
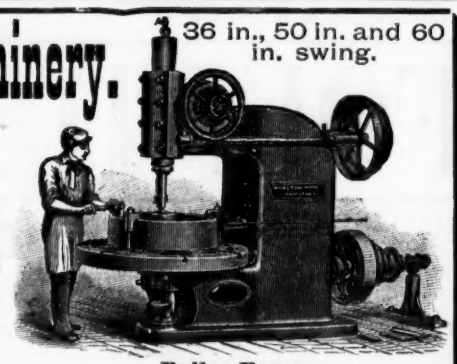


Pulley Lathe.



Pulley Borer.

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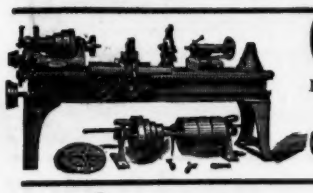

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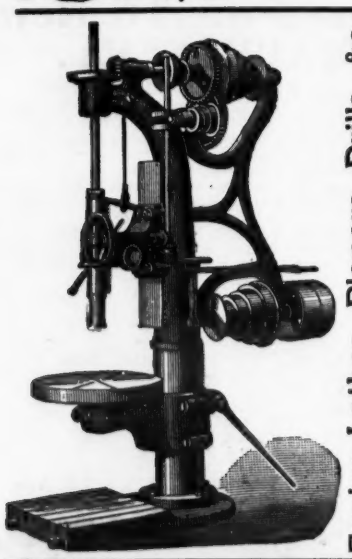

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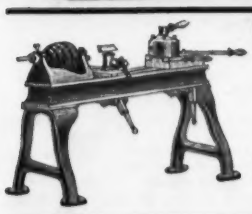

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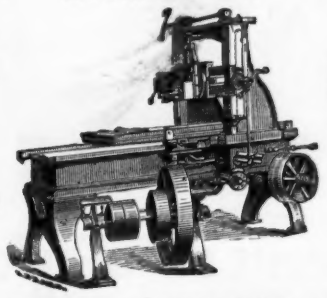

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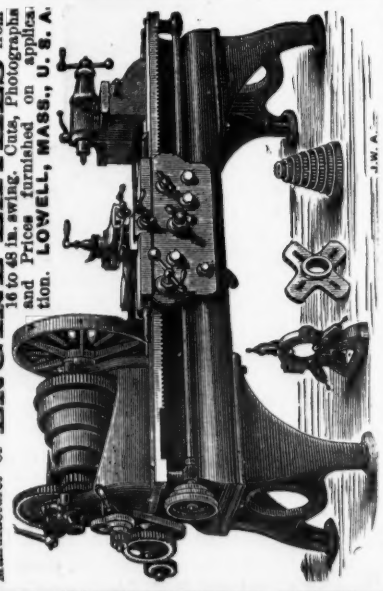

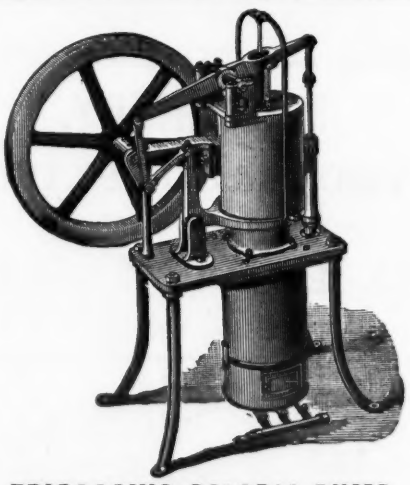

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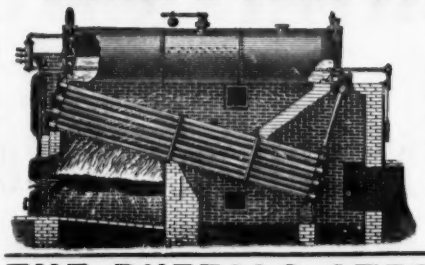

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